LAKE MEAD NATIONAL RECREATION AREA
GRAND CANYON-PARASHANT NATIONAL MONUMENT

ENVIRONMENTAL ASSESSMENT
FOR THE IMPLEMENTATION OF THE
FIRE MANAGEMENT PLAN

National Park Service

Lake Mead National Recreation Area
Grand Canyon-Parashant National Monument
Clark County, Nevada
Mohave County, Arizona

July 2004

US Department of the Interior, National Park Service

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EXECUTIVE SUMMARY
ENVIRONMENTAL ASSESSMENT
FOR THE LAKE MEAD NATIONAL RECREATION AREA
AND GRAND CANYON-PARASHANT NATIONAL MONUMENT
FIRE MANAGEMENT PLAN

This environmental assessment analyzes the impacts of several different alternatives related to the implementation of a fire management plan within Lake Mead National Recreation Area (NRA), and the Lake Mead NRA portion of Grand Canyon-Parashant National Monument (Parashant NM). The Parashant NM is jointly managed by the National Park Service and the Bureau of Land Management (BLM). The ultimate goal of fire management in the National Park System is to restore fire to park ecosystems, where appropriate, through wildland fire use and prescribed fires. This document considers the overall resource management and protection objectives of both wildland fire use and other treatment activities for a ten-year period. However, specific five-year vegetative treatment plans will continue to be developed as needed in the future to address specific treatment activities and burn plans.

This document evaluates the no-action and two action alternatives and analyzes the various environmental and public health and safety impacts of each alternative. The alternatives analyzed are Alternative A: No Action, Continue with Current Management; Alternative B: Implement a Full Suppression Program; and, Alternative C: Combination of Wildland Fire Use and Suppression. In any scenario, human-caused wildland fires will not be considered candidates for wildland fire use and will receive an appropriate suppression response to minimize cost and suppression impacts as well as safety of firefighting personnel.

Project Location

Lake Mead NRA is located in southern Nevada and northwestern Arizona. It contains portions of Clark County, Nevada, and Mohave County, Arizona. It includes two reservoirs (Lakes Mead and Mohave) along 140 miles of the Colorado River. The elevation of Lake Mead NRA ranges from 640 feet in elevation around Lake Mohave, to nearly 7,000 feet at Mt. Dellenbaugh on the Shivwits Plateau of the Parashant NM.

Lake Mead NRA contains 1,501,216 acres of which 1,484,159 acres are in federal ownership administered by the National Park Service (NPS) and 12,568 are nonfederal lands. An additional 4,488 acres surrounding Hoover and Davis Dams are administered by the Bureau of Reclamation (BOR) for operations and security purposes.

In January, 2000, President William Clinton signed a proclamation designating the Grand Canyon-Parashant National Monument. This Monument contains approximately 800,000 acres of land managed by the BLM and 200,000 acres within the boundaries of Lake Mead NRA. The purpose of the Monument is to preserve the vast, biologically diverse, impressive landscape and the array of scientific and historic objects. The Management Plan for the Parashant NM is expected to be completed in 2005.

Need for Action

Directors Order-18, Wildland Fire Management (DO-18) and *Reference Manual-18* (RM-18) require that all parks with vegetation capable of supporting fire develop a fire management plan. In addition, the 1995 Federal Wildland Fire Management Policy and 2001 update directs managers to design all federal fire programs to support resource management objectives.

The overall objective of the fire management plan is to outline in a detailed manner those actions that will be taken by Lake Mead NRA in meeting the fire management goals for the area. In accordance with the *Federal Wildland Fire Management Policy* (1995) and 2001 update, the fire management program will support resource management objectives.

Resource Goals and Objectives for Taking Action

The overall resource goals for the area are to restore natural ecological processes, while protecting the park's natural and cultural resources, and surrounding land uses. The fire management plan provides for active management programs, where necessary, to counteract the detrimental impacts of past actions in the recreation area and national monument. The plan consists of research to understand the ecological relationships involved in the fire program, resource monitoring to understand human influences on natural and cultural resources and the effectiveness of resource management programs, and active management to correct or mitigate unnatural influences as they are identified.

This environmental assessment analyzes the suppression of unwanted ignitions, management of fire use activities, and mechanical hazard fuel reduction treatment activities within the recreation area.

Issues

Public scoping was conducted in January and February, 2001 through the publication of press releases in area newspapers and through information available on the Lake Mead NRA Web site. No public comments were received. The Lake Mead NRA and Parashant NMinterdisciplinary team has identified issues related to the implementation of the proposed fire management strategies. These issues are based on input from specialists in the NPS, as well as from other local, state, and federal agencies. These issues were used for the development of the impact topics, to focus the analysis on the most relevant subject matter and resources of concern. The issues analyzed in the environmental assessment include vegetation, soils, wildlife, species of special concern, air quality and visibility, scenic quality, water resources, wetlands and floodplains, visitor use, socioeconomic resources, cultural resources, park operations, public health, safety, land use, and wilderness.

Alternative Selected for Analysis

Alternative A, No Action, is the continuation of the current management within the recreation area. Under this alternative, the fire management program would utilize suppression, wildland fire use, prescribed fire, and mechanical hazard fuel reduction. Existing fire management units (FMUs) as designated in the Lake Mead NRA 1997 Prescribed Natural Fire Plan, would remain within Lake Mead NRA and would include suppression zones, wildland fire use zones, and resource restoration through the use of prescribed fire. The low desert area would remain designated as a full suppression zone. A wildland fire use program would continue on portions of the Shivwits Plateau area of Parashant NM. Initial attack suppression actions would be taken

on all human-caused wildland fires. Suppression actions would be taken on all escaped prescribed fires, and lightning-caused fires that are within the suppression units would be suppressed.

Alternative B is the full suppression alternative. Under this alternative all ignitions, whether of natural origin or human-caused, would be suppressed. Suppression would be accomplished through the use of confinement, containment, or control tactics. Control objectives would seek to limit fire spread as quickly as possible, while ensuring public and firefighter safety, protecting the cultural, natural, and historic resources, and minimizing costs.

Alternative C is a combination of wildland fire use and full suppression. Under this alternative, three fire management units (FMU) would be designated within Lake Mead NRA and Parashant NM: 1. Interface (FMU1); 2. Desert below 6,000 feet (FMU2); and, 3. Shivwits Plateau (FMU3). Lake Mead NRA and Parashant NM FMU's are differentiated by management objectives, fuels, political boundaries, and values-to-be-protected. Initial attack suppression actions would be taken on all human-caused wildland fires. Suppression actions would be taken on all escaped prescribed fires, and lightning-caused fires that are within the suppression units would be suppressed. This alternative is similar to the management under the no action Alternative. However, it differs from Alternative A in that it establishes management goals for the interface portions of the recreation area.

Environmentally Preferred Alternative

Alternative C is the environmentally preferred alternative because, overall, it would best meet the requirements of Section 101 of NEPA. It would provide protection to the Lake Mead NRA and Parashant NM environment, including protecting the Mojave Desert environment from the spread of non-native vegetation. It would help enhance the quality of the vegetative communities on the Shivwits Plateau, by restoring the natural processes, while utilizing control measures to preserve important historic, cultural, and natural aspects of our national heritage. Overall, it would ensure a safe, healthful, productive, and esthetically and culturally pleasing surrounding.

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SECTION I: PURPOSE AND NEED FOR ACTION

Introduction

The National Park Service (NPS) is considering alternatives related to the development of a fire management plan for Lake Mead National Recreation Area (NRA) and the Lake Mead NRA portion of Grand Canyon-Parashant National Monument (NM), often referred to as the Shivwits Plateau. This section describes the purpose and need for the action; provides an overview of the history of fire management within the recreation area, including related planning documents, policies, regulations, and laws; provides information on the topics analyzed under each alternative; and identifies issues and impacts related to fire management.

Directors Order-18, Wildland Fire Management (DO-18) and *Reference Manual-18* (RM-18) require that all parks with vegetation capable of supporting fire develop a fire management plan. In addition, the 1995 Federal Wildland Fire Management Policy and 2001 update direct managers to design all federal fire programs to support resource management objectives. The ultimate goal of fire management in the National Park System is to restore fire to park ecosystems, where appropriate, through wildland fire use and prescribed fires. This document considers the overall resource management and protection objectives of both wildland fire use and other treatment activities, however, specific five-year plans will continue to be developed as needed in the future to address specific treatment activities and burn plans.

In any scenario, human-caused wildland fires will not be considered candidates for wildland fire use and will receive an appropriate management response to minimize cost and suppression impacts as well as safety of firefighting personnel.

This document evaluates the no-action and two action alternatives and analyzes the various environmental and public health and safety impacts of each alternative. The alternatives analyzed are Alternative A: No Action, Continue with Current Management; Alternative B: Implement a Full Suppression Program; and, Alternative C: Combination of Wildland Fire Use and Suppression.

Project Site Location

Lake Mead NRA is located in southern Nevada and northwestern Arizona (Figures 1 and 2). It is bounded on the north by the town of Overton, Nevada, the Virgin Mountains, and the Shivwits Plateau; on the east by Grand Canyon National Park and Bureau of Land Management (BLM) administered lands; on the south by Bullhead City, Arizona, and Laughlin, Nevada; and on the west by Boulder City, the Eldorado Mountains, and the Newberry Mountains. It contains portions of Clark County, Nevada, and Mohave County, Arizona. It includes two reservoirs (Lakes Mead and Mohave) along 140 miles of the Colorado River. The elevation of Lake Mead NRA ranges from 640 feet in elevation around Lake Mohave, to nearly 7,000 feet at Mt. Dellenbaugh on the Shivwits Plateau of the Parashant NM.

The majority of the land within the recreation area is comprised of Mojave Desert communities. Lake Mead NRA contains an area on the North Rim of the Grand Canyon, commonly referred to

Figure 1. Lake Mead NRA and Parashant NM Region

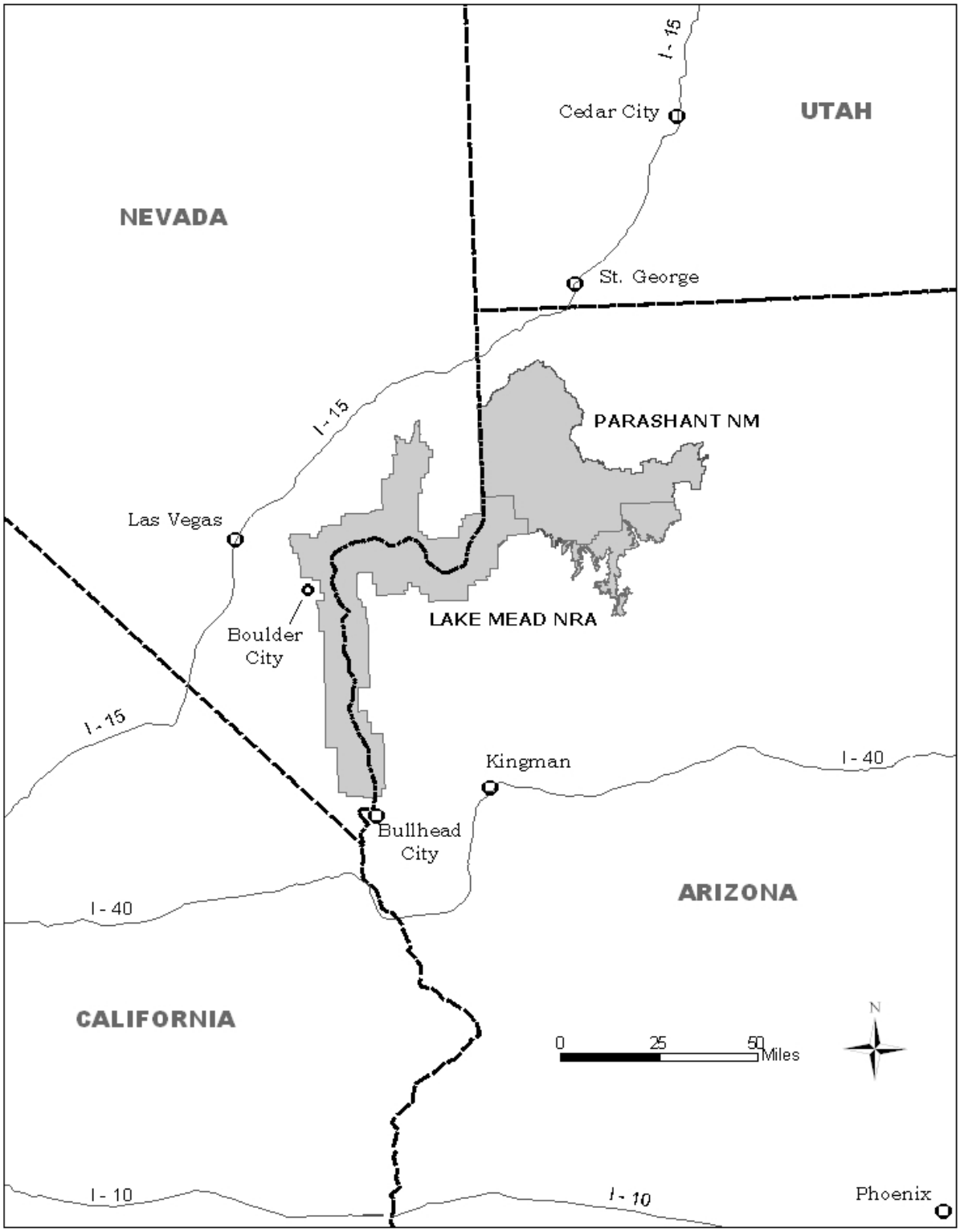
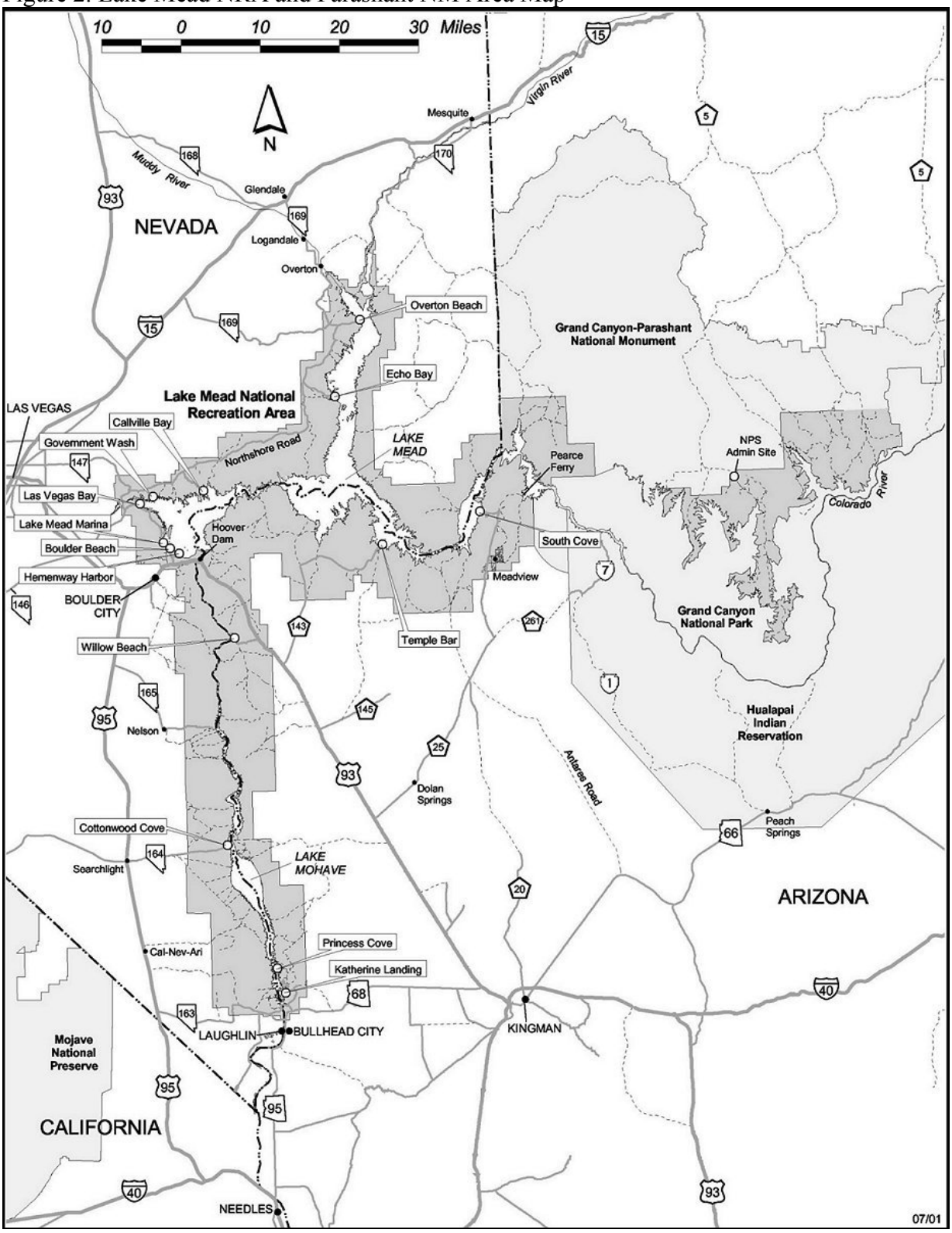


Figure 2. Lake Mead NRA and Parashant NM Area Map



as the Shivwits Plateau. This portion of Lake Mead NRA is included in the newly designated Grand Canyon-Parashant National Monument.

Lake Mead NRA contains 1,501,216 acres of which 1,484,159 acres are in federal ownership administered by the National Park Service (NPS) and 12,568 are nonfederal lands. An additional 4,488 acres surrounding Hoover and Davis Dams are administered by the Bureau of Reclamation (BOR) for operations and security purposes. Parashant NM contains 1,014,000 acres of land, of which approximately 209,000 acres are within the boundary of Lake Mead NRA and managed by the NPS.

The recreation area has nine major developments around the two lakes, six on Lake Mead and three on Lake Mohave. There are no major developed areas within Parashant NM. The developments are centered around marina activities and most have concession services and can accommodate overnight visitors and day use activities. Both lakes have undeveloped coves that are accessible by water or on approved roads. There are over 800 miles of approved backcountry roads within the recreation area and the NPS portion of the Parashant NM.

Annual visitation to Lake Mead NRA exceeded 9 million visitors in 2001. The majority of park visitation occurs during the summer months and involves water-based recreation. However, visitation is increasing in the spring and fall as visitors discover the backcountry regions of the recreation area through hiking and travel on the approved road system.

Purpose and Need

The management authorities for the NPS, including, DO-18 (1998) and RM-18 (1999) require that all parks with vegetation capable of supporting fire develop a fire management plan. The overall objective of the fire management plan is to outline in a detailed manner those actions that will be taken by Lake Mead NRA in meeting the fire management goals for the area. In accordance with the *Federal Wildland Fire Management Policy* (1995) and 2001 update, the fire management program will support resource management objectives.

The overall resource goals for the area are to restore natural ecological processes, while protecting the park's natural and cultural resources, and surrounding land uses. The fire management plan provides for active management programs, where necessary, to counteract the detrimental impacts of past actions in the recreation area. The plan consists of research to understand the ecological relationships involved in the fire program, resource monitoring to understand human influences on natural and cultural resources and the effectiveness of resource management programs, and active management to correct or mitigate unnatural influences as they are identified.

This environmental assessment analyzes the suppression of unwanted ignitions, management of fire use activities, and mechanical hazard fuel reduction treatment activities within the recreation area.

Background
The NPS began managing the recreation facilities and land areas around Lake Mead in 1936, after the completion of Hoover Dam, through an inter-agency agreement with the BOR. The management area was expanded in 1947 to include the proposed Lake Mohave, which was completed in 1953. Lake Mead NRA was officially established as a unit of the National Park System on October 8, 1964 "for the general purposes of public recreation, benefit, use…in a manner that will preserve, develop, and enhance, so far as practicable, the recreation potential, in a manner that will preserve the scenic, historic, scientific, and other important features of the area (Public Law 88-639)."

The recreation area boundary was modified in 1975 when the *Grand Canyon Expansion Bill* authorized more than 300,000 acres administered by Lake Mead NRA be transferred to Grand Canyon National Park. In 2000, the Grand Canyon - Parashant National Monument (NM) was established. This national monument is jointly managed by the BLM and NPS and includes 209,297 acres administered by the NPS at Lake Mead NRA, of which 156,473 acres is located on the Shivwits Plateau.

Lake Mead NRA is considered one of the premier water-based recreation areas in the nation. Although providing recreational opportunities is an important component of Lake Mead NRA, the NPS also protects and preserves over one million acres of land-based resources, including portions of the Mojave Desert and Great Basin Desert ecosystems.

The History of Fire in the Recreation Area
Wildland fire has long been recognized as one of the important environmental factors shaping many vegetation communities. Fires in the low desert ecosystems are not common, and little is known about the fire history in the Mojave Desert. Fire has played an important role in the history of the Great Basin communities of the Shivwits Plateau.

Very few wildfires have occurred in the low desert ecosystem of Lake Mead NRA, due primarily to spacing of fuels, lack of fuels and gravelly rocky terrain. The Newberry Mountain range at the southern extent of the recreation area has had several fires in the past ten years. This area is comprised of Mojave Desert scrub, and generally has more grasses and forbs than other portions of the recreation area. Typically, once fire reaches a lower elevation where the fuels are sparse, or it meets a rocky bluff, it extinguishes itself.

However, according to the U.S. Geological Survey, since the 1970s, nonnative grasses have invaded the desert and have led to more fires (2001). The dried remains of non-native grasses, such as *Bromus* and *Schismus*, can provide highly flammable dense stands that ignite easily and carry fire rapidly. The invasion of non-native grasses has changed the role of fire in this ecosystem, and there is the potential for more frequent fires in the low desert areas of Lake Mead NRA.

Past wildfires have occurred in riparian areas where tamarisk is the dominant vegetation, but posed little threat of spreading outside the "pocket" of tamarisk, again, due to lack of fuels, spacing of fuels, and rocky terrain that surrounds the tamarisk habitat. Since tamarisk is a non – native species it is difficult to determine if fire played any part in its ecological development.

But since it occurs near water and its foliage has a high water and salt content, it is said to be fire-adapted. Prescribed burns for the purposes of tamarisk control and removal have been conducted in these areas in the past with good results if followed by a post-burn herbicide treatment.

Information is known about the fire history in the Great Basin desert ecosystem, which includes the Shivwits Plateau area. Historical records and tree scar evidence have been used to determine the fire history of the Shivwits Plateau area. Until the late 1800s to early 1900s, ponderosa pine stands typically experienced frequent, low intensity ground fires. These fires maintained stand health and gave the appearance of an open park-like stand. Past fire suppression and grazing management activities have caused the open stands to close in, which has increased the potential fire severity. The encroachment of pinyon-juniper on what was once a grass/forb/shrub area is due again in part from fire suppression and grazing activities. Once established, the pinyon-juniper out-competed other vegetation, such as fine fuels including grasses, forbs, and brush. The sagebrush areas have also been changed from past grazing management activities and fire suppression. The sagebrush community has out-competed grasses and forbs in large portions of the Shivwits Plateau.

From 1936 to 1992, the operational fire policy at Lake NRA was to suppress all fire starts, natural or otherwise, whenever possible. While the exclusion of fire from the low desert areas of the Mojave Desert portions of the recreation area in effect probably did not alter the natural fire regime of that area, the exclusion of fire as an ecosystem process prevented a major natural cause of necessary disturbance in the sagebrush scrub and pinyon-juniper woodlands of the Shivwits Plateau. Past suppression and other human-caused disturbance has led to a monoculture community of sagebrush and pinyon-juniper in large portions of the Shivwits Plateau, with limited amounts of grasses and forbs, reducing the quality of habitat for wildlife.

The *Lake Mead National Recreation Area Fire Management Plan* (1992) reaffirmed the continuation of a full suppression policy in the park, along with the initiation of a limited prescribed burn program. This plan called for the implementation of an experimental prescribed fire program on areas of the Shivwits Plateau, Arizona, in areas where past management practices, such as fire suppression, and chaining to create pastures, had altered the native vegetation. The objectives of the experimental program were to evaluate the effectiveness of fire in restoring native vegetation and decreasing hazard fuels.

A 4-year burn plan on the Shivwits Plateau, identifying specific burn units, was implemented after the adoption of the 1992 plan. Since 1994, approximately 4,500 acres of juniper woodlands have been treated at the Twin Point area of the Shivwits Plateau, and about 600 acres of ponderosa pine forests have been treated, both through the use of prescribed burns (Table 1). The success of the program is being monitored through fire effects monitoring, field studies, and photo points. The burn objectives are being met in some areas, though recovery results have been mixed in the treatment areas. It is still too early to assess if the program is meeting the overall management goals.

Table 1. Completed Prescribed Burns – Shivwits Plateau

UNIT NAME	YEAR BURNED	ACRES	PROJECT TYPE
Twin 1	1995	407	Juniper, sagebrush
Sawmill	1995	30	Ponderosa Pine
Green Springs	1997	70	Ponderosa Pine
Twin II	1997	1761	Juniper, sagebrush
Horse Valley	1998	67	Ponderosa Pine
Twin Creek	1999	429	Juniper, sagebrush
Twin Spring Boundary	1999	623	Juniper, sagebrush
Twin West	1999	1386	Juniper, sagebrush
Pine Valley Loop	1999	41	Ponderosa Pine
Pleasant Valley	1999	191	Ponderosa Pine
Pine Valley West	1999	170	Ponderosa Pine
Fire Camp Complex	1995,1997	89	Ponderosa Pine
Waring	1997	168	Ponderosa Pine

The burn goals included:

1. To restore fire as a natural process.

2. To use fire as a management tool to meet natural and cultural resource management objectives.

3. To increase diversity and promote the establishment of native grasses and forbs to aid in preventing soil erosion and increase wildlife forage.

4. To restore natural fuel loadings and ecosystem structure in vegetative communities those have been significantly altered by past fire suppression and grazing activities.

5. To monitor and evaluate the effects of fire management activities on the park ecosystem.

In 1997, the *Prescribed Natural Fire Plan for the Shivwits Area, Arizona*, was implemented. Although this plan referenced prescribed natural fires (ignitions by natural means), not prescribed fires (management-ignited fires), its primary purpose, to meet natural resource management objectives and fire management goals, are similar to those of the prescribed fire program.

Since the inception of this program, NPS policies have been revised, and each unit of the National Park System is directed to reevaluate their fire management strategies in accordance with DO-18 and RM-18.

The first step in evaluating the fire management strategies at Lake Mead NRA and the Parashant NM was to determine the appropriate management strategy to meet the resource goals on the

Shivwits Plateau area, Arizona. This was accomplished in early 2002 with the implementation of the vegetative treatment and hazard fuel reduction plan and environmental assessment (Appendix A). The primary purposes of the experimental five-year vegetative treatment program is to attempt to restore fire as a natural process in the Shivwits Plateau region of Parashant NM; to restore natural fuel loadings and ecosystem structure in vegetative communities that have been altered by past management activities; to increase biodiversity and promote the establishment of native grasses and forbs to aid in preventing soil erosion and increase wildlife forage; and, to restore wildlife habitat and increase potential habitat for sensitive species. This is an adaptive management program that would continue to be refined based on research, fire effects monitoring, and overall accomplishment of program goals.

The second step in the fire management program is to determine the appropriate response to wildland fires in order to meet resource management and public safety objectives. The Lake Mead NRA and Parashant NM fire management plan would provide the framework to make these decisions.

Compliance Activities

This environmental assessment evaluates a range of fire management strategies and their impacts on the environment and the effects related to the implementation of a fire management program in the recreation area. The *Wildland Fire and Prescribed Fire Policy Implementation and Reference Guide* (1998) described a range of fire management strategies available. An interdisciplinary team evaluated these strategies and determined a range of alternative strategies for specific areas within the recreation area and national monument.

This document also includes discussion of alternatives that have been ruled out and provides justifications for their elimination. This environmental assessment has been prepared in accordance with the *National Environmental Policy Act of 1969* (NEPA), regulations of the Council of Environmental Quality (CEQ) (40 Code of Federal Regulations [CFR] 1508.9), and *Director's Order-12, Conservation Planning, Environmental Impact Analysis, and Decision Making* (DO-12) (2001).

This is a programmatic environmental assessment in that it establishes a direction for overall fire management within the recreation area. Additional compliance may be required for site specific actions where the potential for sensitive cultural or natural resources exist, or where the action is in an area of public concern. The NPS will collaborate with the public during the scoping and review phases for any site-specific proposals.

Related Laws, Policies, and Planning Documents

The administration of the fire management program is authorized by the *National Park Service Organic Act of 1916* (16 USC § 1). NPS *Management Policies* (2001) state that natural fires must be permitted to continue if truly natural systems are to be perpetuated. Fire management goals are addressed generally in the *Lake Mead National Recreation Area Statement for Management* (2001). This document maintains that the NPS will "manage the recreation area's wildlife and botanic communities to enable the re-establishment of naturally functioning ecosystems." Implementation of the Fire Management Plan would support Lake Mead NRA's

Statement for Management by re-establishing fire as an ecological process in order to restore the natural biotic systems.

NPS *Guidelines for Fire Management*, RM-18, further define the Service-wide goal of wildland fire management to achieve resource objectives of the park through the prevention of human-caused wildfire, to minimize the negative impacts on resources from all wildfires that occur, to protect cultural resources, and to perpetuate the natural resources and their associated natural processes.

This project corresponds to the Lake Mead NRA *Resource Management Plan* (1999), and the natural resource and fire management objectives set by the draft *Parashant Interdisciplinary Management Plan* (1997) and the Grand Canyon-Parashant NM *Current Management Guidelines* (2002).

The resource management plan provides for active management programs where necessary to counteract detrimental impacts of past actions in the recreation area. The plan consists of research to understand the ecological relationships involved, active management programs to correct or mitigate unnatural influences as they are identified, resource surveillance to monitor current influences of humans on natural and cultural resources, and the effectiveness of resource management programs. The RMP cites the exclusion of fire from the recreation area as a threat to native vegetation and specifically states that fire dependent communities, such as the pinyon-juniper woodland, have been altered due to the absence of fire.

The draft *Parashant Interdisciplinary Management Plan* (1997) considers the management of fire for pre-planned enhancement of resources. Objective C of the plan is to restore fire regimes to the highest priority areas within the Parashant area by the year 2000. The Grand Canyon-Parashant NM *Presidential Proclamation* (2000) provided the framework for the management of the monument. All planning documents are reviewed for consistency with the Proclamation. Existing management documents were incorporated into one document, the *Current Management Guidance* (2002). This document provides guidance for managing specific activities until the time that BLM and NPS managers develop a management plan for the monument. The fire management objectives and restraints have been incorporated into the *Current Management Guidance* document.

The recreation area contains designated, proposed wilderness, and proposed potential wilderness. NPS-77, *Resource Management Guidelines* (1991), NPS Directors Order 41, *Wilderness Preservation and Management* (1999), and NPS *Management Policies* (2001) specifically state that the term wilderness includes the categories of *designated, proposed, potential, recommended, study areas,* and *suitable*, and that wilderness policies apply in these areas regardless of the category. A goal of this fire management plan is to preserve the character of wilderness areas in the recreation area.

NPS *Management Policies* (2001) requires the analysis of potential effects of each alternative to determine if actions would impair park resources. To determine impairment, the NPS must evaluate "the particular resources and values that would be affected; the severity, duration, and timing of the impact; the direct and indirect effects of the impact; and the cumulative effects of the impact in question and other impacts." (1.4.4). The NPS must always seek ways to avoid or minimize, to the greatest degree practicable, adverse impacts on park resources and values.

However, the laws do give the NPS management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, as long as the impact does not constitute impairment to the affected resources and values (1.4.3).

NPS units vary based on their enabling legislation, natural and cultural resources, missions, and the recreational opportunities appropriate for each unit, or for areas within each unit. An action appropriate at Lake Mead NRA as designated by the enabling legislation, may impair resources in another unit. This environmental assessment analyzes the context, duration, and intensity of impacts related to the fire management program within Lake Mead NRA and Parashant NM, as well as the potential for resource impairment, as required by Director's Order 12, *Conservation Planning, Environmental Impact Analysis and Decision Making* (2001).

Authority for Action

The Management Policies for the NPS require that all parks with vegetation capable of supporting fire develop a fire management plan. The fire management plan will implement components of the *Lake Mead National Recreation Area Resource Management Plan* (1999). Authority for managing a fire management program at Lake Mead NRA and Parashant NM is authorized by the *National Park Service Organic Act of 1916*.

Potential Issues and Impact Topics

Public scoping was conducted in January and February, 2001 through the publication of press releases in area newspapers and through information available on the Lake Mead NRA website (Appendix B). It was hoped that issues would be identified by the public related to fire management at Lake Mead NRA; however, no public comments were received. The Lake Mead NRA and Parashant NM interdisciplinary team has identified issues related to the implementation of the proposed fire management strategies. These issues are based on input from specialists in the NPS, as well as from other local, state, and federal agencies. These issues were used for the development of the impact topics, to focus the analysis on the most relevant subject matter and resources of concern. A brief rationale for each issue follows, as well as the reasons for dismissing specific topics from further analysis.

Vegetation: Fire plays an important role in the changes to vegetative cover in certain vegetative communities, which in turn can affect the habitat and overall ecological health. As a result of natural ignitions being allowed to burn under pre-set conditions, shrub and woodland communities may return to early successional stages. Eventually, fires could lead to increased biodiversity by creating vegetative mosaics. Non-native vegetation, such as cheat grass, could invade the area after a fire, creating a monoculture type community.

In the low desert areas, fires could lead to increased occurrence of non-native grasses that could alter the fire regime in these areas. Suppression activities could damage vegetation.

Soils: NPS policies and *Special Directive 91-6* requires the consideration of impacts on topography and soils. Soils within certain areas, including the Shivwits Plateau, are highly erosive. Fires in and around riparian areas could consume streamside vegetation or upslope cover, leading to increased erosion. However, fires can benefit soils by the return of nutrients, and, in the long-term, increase vegetative cover and reduce erosion.

In the low desert areas, suppression activities could damage soils and alter the topography of an area by the creation of fire lines.

Wildlife: Wildlife would be temporarily displaced from burn areas, and there may be mortality of animals that are unable to move away from the fire. Wildlife habitat could improve from the creation of vegetative mosaics.

Wildlife habitat in the low desert areas could be detrimentally impacted if fires consumed large acreages and non-native vegetation became established. Suppression activities could harm wildlife and wildlife habitat.

Species of Special Concern: The *Endangered Species Act of 1973, as amended*, requires disclosure of potential impacts to all federally threatened or endangered species. NPS policy requires analysis of the effects on federally listed species, and other species of concern. Listed species are included in Appendix C. Fire suppression zones have been designated around known critical and sensitive habitats and special status species habitat. In these areas, appropriate suppression activities would occur to protect these resources, however, since all areas have not been surveyed, there could be unknown populations of these species impacted by fire events or suppression activities.

Suppression activities in the low desert communities could potentially adversely affect desert tortoise and designated critical habitat. Fire activities in riparian areas could potentially adversely affect the endangered Southwestern willow flycatcher and the candidate relict leopard frog.

A complete evaluation of the impacts to threatened, endangered, and candidate species, and critical habitat, has been conducted in a biological assessment. Components of the assessment are included in this document.

Air Quality and Visibility: The *Clean Air Act of 1990, as amended,* stipulates that federal land managers have an affirmative responsibility to protect air quality and related values within the parks. The recreation area has been designated as a Class II airshed, while the adjacent Grand Canyon NP was designated a Class I airshed. Air quality and visual resources would be impacted during any type of ignition by smoke. Smoke could temporarily decrease visibility in the recreation area and in adjacent areas.

Suppression activities in the low desert areas could increase dust and create visual impacts in that area.

Scenic Quality: Preservation of the scenic features of the area is a component of the enabling legislation for Lake Mead NRA and proclamation for Parashant NM. Smoke and burned areas could temporarily impact the scenic quality of the area. Scars from suppression activities could detract from the natural scenery of the area.

Water Resources: NPS policies require the protection of water resources in accordance with the *Federal Water Pollution Control Act of 1987, as amended* (Clean Water Act). Fires could lead to decreased cover, which could result in soil erosion and run-off, impacting water resources. Water supply, or lack of water, in certain areas of the recreation area is also an issue. The lack of water could influence management of fires within the recreation area.

Fire and follow-up activities in riparian areas where tamarisk is present could negatively impact water quality in those areas. There are potential positive benefits to water quality and riparian areas from these activities, including increased and improved native riparian habitat, and increased surface flows following tamarisk eradication.

Wetlands and Floodplain Management: Management-ignited burns in wetlands have proven effective in reducing and eliminating non-native tamarisk from springs within Lake Mead NRA. These types of management activities would continue under all alternatives within this environmental assessment because one of the primary objectives of the recreation area is to restore native springs to near natural conditions. Once restored, it is unlikely that natural fires would play a role in the springs.

Fires have occurred in tamarisk stands, which are located along Lakes Mead and Mohave. These fires generally pose little threat of spreading away from the lakeshore due to lack of fuels, spacing of fuels, and rocky terrain. However, there may be a risk during years with high annual growth.

Visitor Use: Temporary closures of certain areas to visitors could occur due to fire activity, either during suppression operations or the monitoring and managing the fires.

Socioeconomic Resources: Grazing is currently authorized on portions of the Shivwits Plateau and in certain low desert areas of the recreation area. Fire would impact grazing activities, as ranchers would be required to adjust areas of use based on fire activity.

Cultural Resources: The *National Historic Preservation Act, (as amended in 1992),* the *National Environmental Policy Act* (1969), and NPS policies require the consideration of impacts on cultural resources listed or eligible for listing on the National Register of Historic Places. Section 106 of the *National Historic Preservation Act* requires an assessment of impacts to cultural resources. Fire suppression zones have been designated around known cultural and historic resources, however, impacts to unknown resources could occur. Traditional Cultural Properties and other ethnographic resources also are present in the recreation area and tribal consultation would be a component of the fire plan.

Park Operations, Public Health and Safety: Public safety and the safety of all personnel engaged in the fire event is the primary concern of park management. Fire management activities can be dangerous. Hiring and training of temporary or seasonal personnel would be necessary to meet the objectives of the fire management program. Temporary restrictions on public use could occur during fires. Fire suppression zones would be designated to protect administrative structures, residential areas, fences, and recreational sites.

Land Use (Designated, Suitable and Potential Wilderness, Adjacent Land Use, Permitted Right-of-Ways): The *Wilderness Act of 1964*, NEPA (1969), and NPS Management Policies requires the assessment of the effects on wilderness values for all designated, proposed, and suitable or potential wilderness areas. The Lake Mead NRA original Wilderness Proposal (1979, unpublished) determined that 418,655 acres of recreation area lands met the criteria for wilderness designation and 262,125 acres potentially met the criteria. In 2002, approximately 184,430 acres of wilderness in Nevada were designated under the *Clark County Conservation of Public Land and Natural Resources Act of 2002*. All designated, suitable/proposed, and proposed potential wilderness areas are managed to preserve the wilderness values, and the effects of the fire management program will be evaluated for all the alternatives. In addition, a minimum tool analysis will be utilized to determine the appropriate response in designated, proposed, and proposed potential wilderness areas (Appendix D). Minimum impact suppression techniques (MIST) would be used for fires within the recreation area (Appendix E).

Adjacent land uses on BLM administered lands and Grand Canyon National Park (NP) are an issue. Fires could spread to these areas. These areas also have designated or proposed wilderness that is an issue when determining the appropriate tools for fire suppression.

Issues Considered but Dismissed from Further Consideration

Several issues were considered during the planning process but were considered insignificant. None of the alternatives would have adverse impacts on wild and scenic rivers as there are none in the area. The project area is not located in a sole or principal drinking water aquifer. Since the project area is not in a designated ecologically significant or critical area and is not listed on the Department of the Interior's National Registry of Natural Landmarks, no impacts would occur to these resources. The project would have no impact to socially or economically disadvantaged populations (Environmental Justice EO 12898).

Wild and Scenic Rivers: There are no designated wild and scenic rivers within the recreation area therefore, they would not be affected by the proposed plan.

Prime and Unique Farmlands: The Council on Environmental Quality (CEQ) requires an assessment of impacts to all prime and unique farmland within the project area. These resources do not exist within the recreation area, therefore, this was not considered a relevant impact topic.

Environmental Justice: Executive Order 12898, "General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of their actions on minorities and low-income populations and communities. The communities surrounding the recreation area contain a mix of incomes and ethnic backgrounds and are not considered predominately minority or low-income. The proposals contained within the environmental assessment would not have adverse impacts on minorities and low-income populations, therefore this topic is not addressed further.

National Natural Landmarks: There are no designated National Natural Landmarks within the recreation area, therefore this topic was dismissed from further analysis.

The proposal would also have no issues related to energy requirements, natural or depletable resource requirements and conservation potential.

Objectives in Taking Action

The overall objective of the fire management plan is to outline in a detailed manner those actions that will be taken by Lake Mead NRA in meeting the fire management goals for the area. In accordance with the *Federal Wildland Fire Management Policy* (1995) and 2001 update, the fire management program will support resource management objectives.

The overall resource goals for the area are to restore natural ecological processes, while protecting the park's natural and cultural resources, and surrounding land uses. The fire management plan provides for active management programs, where necessary, to counteract the detrimental impacts of past actions in the recreation area. The plan consists of research to understand the ecological relationships involved in the fire program, resource monitoring to understand human influences on natural and cultural resources and the effectiveness of resource management programs, and active management to correct or mitigate unnatural influences as they are identified.

Implementation of the fire management plan will support the mission outlined in the *2001 Lake Mead National Recreation Area Strategic Plan* (NPS 2001). The primary goal set forth in the Strategic Plan is to protect, restore, and maintain in good condition the natural and cultural resources and associated values of Lake Mead NRA and to manage these resources and values within the broader ecosystem and cultural context.

Under this broad goal are several goals that relate to fire management.

- Disturbed Lands: Lake Mead NRA targeted parklands, disturbed by prior physical development or agricultural uses, are restored.

Park lands, where natural processes have been significantly altered by past land-use and visitor-use practices, must be restored to their natural condition. This goal targets selected lands impacted by former uses for restoration and containment of invasive plant and animal species, removal or better management of grazing, expanding the role of natural fire and riparian restoration.

The NPS will work within the Grand Canyon-Parashant NM planning process to develop goals and standards for a restoration plan for the Shivwits Plateau. The NPS will incorporate input from professional hydrologists and foresters, including goals and actions for alleviation of soil erosion, utilization of fire and other tools for ecological restoration, and wildlife management.

- Non-native Plant Species: Non-native vegetation on 10% of 400 targeted acres of Lake Mead NRA lands is contained.

Non-native plant species threaten parks because they often replace native species, disrupt natural processes, and otherwise destroy natural systems. By eliminating or geographically containing

the targeted species the NPS can help restore natural systems. The primary focus within Lake Mead NRA over the next five years will be nonnative species within riparian areas associated with park springs, and selected shoreline areas of Lake Mohave.

The NPS will work with Grand Canyon-Parashant NM to establish restoration goals for the Shivwits Plateau, addressing erosion, vegetation recovery and use of prescribed fire. The NPS will ensure that cultural resource monitors are involved in burn preparation, pre-suppression, and suppression activities.

In addition, the following goals, associated objectives, and strategies have been established within the fire management plan.

Goal: Make firefighter and public safety the highest priority of every fire management activity. Develop and maintain staff expertise in all aspects of fire management. Foster public participation in fire management activities.

Objective: Ensure all wildland fire and prescribed fire operations sustain no injuries to firefighters or members of the public

Strategies:

- All personnel involved in fire management operations will receive a safety briefing describing known hazards and mitigating actions, current fire season conditions and current and predicted fire weather and behavior prior to any planned or unplanned wildfire activity.
- Fire management operations will be carried out by qualified individuals that promote the safe and skillful application of fire management strategies and techniques.
- Recreation area neighbors, visitors and the local residents will be notified of all planned and unplanned fire management activities that have the potential to impact them.
- All or portions of the recreation area will be closed to the public when fire activity poses a threat to human safety (at the discretion of the Superintendent).

Goal: Manage prescribed and wildland fires in concert with federal, state and local air quality regulations.

Objective: Ensure air quality thresholds for National Ambient Air Quality Standards (NAAQS) are not exceeded and visual quality is not reduced in adjacent airsheds due to fire use activities.

Strategies:

- Impacts to air quality will be considered as a part of the go/no go decision in the Wildland Fire Implementation Plan, Stage I, and periodic assessment throughout the duration of any wildland fire.
- Air quality impacts will be addressed as a part of the alternative development and selection in the Wildland Fire Situation Analysis.
- Air quality objectives will be incorporated in each prescribed burn plan.
- Smoke impact mitigation measures will be developed and implemented for prescribed burn and all wildland fire actions.
- Alternative methods (e.g., mechanical, biological, etc.) to fire use will be analyzed prior to

selecting fire use treatments.

Goal: Suppress all unwanted and undesirable wildland fires regardless of ignition source to protect the public, check fire spread onto private property, and protect the natural, cultural and historic resources of the recreation area.

Objective: Contain 95% of unwanted wildland fires at less than 100 acres in size.

Strategies:

- Prioritize suppression actions on fires or portions of fires that threaten to damage public property.
- Ensure recreation area fire personnel are trained and qualified for wildland fire operations.
- Ensure recreation area engines and Type 1 crew are in a state of readiness during fire season.
- Ensure recreation area staff responsible for fire operations understands fire policy.

Goal: Use fire management, wherever appropriate, to sustain and restore natural resources and protect natural resources from adverse effects of fire and fire management activities.

Preserve historic structures, landscapes and archeological resources from adverse effects of fire and fire management activities, and use fire management, wherever appropriate, to rehabilitate or restore these cultural resources.

Objective: Manage suppression actions so that rehabilitation costs are less than 10% of suppression costs.

- Ensure wildland fire suppression operations employ Minimum Impact Suppression Tactics (MIST).
- Ensure fire operations personnel are briefed on recreation area resources and potential damage from fire and suppression actions.

Goal: Facilitate reciprocal fire management activities through the development and maintenance of cooperative agreements and working relationships with pertinent fire management entities.

Objective: Annually review and modify as necessary agreements with the agencies listed below.

Coordinate with the following entities:

Las Vegas Interagency Communications Center
BLM Las Vegas Field Office
BLM Yuma Field Office
BLM Arizona Strip Field Office
USFS Spring Mountain Ranger District
Grand Canyon-Parashant National Monument
Clark County, Nevada Fire Department
Mojave County, Arizona Fire Department
City of Logandale Nevada
South Zone Interagency Dispatch
BLM Phoenix Field Office
BLM California Desert District
Grand Canyon National Park
Henderson Fire Department
Boulder City Fire Department
City of Laughlin Nevada
City of Overton Nevada
City of Meadview Arizona

Lake Las Vegas Development
Nevada Division of Wildlife
Moapa Tribal Council
Nevada Division of Forestry
Nevada State Parks, Valley of Fire

Goal: Use wildland and prescribed fire where and when appropriate as a tool to meet resource management objectives within the recreation area. Maintain or restore, where possible, the natural resources of the recreation area, and those ecological conditions that would prevail were it not for the advent of modern civilization. Refine management practices by improving knowledge and understanding of fire through research and monitoring.

Objective: Restore fire to 5% of the fire-adapted ecosystems within the recreation area within the next five years.

Ponderosa Pine

Site conditions following initial fire treatment:

- Reduce forest litter and duff by 50 to 80% immediate post burn.
- Reduce fuel loading of dead and down fuels <20" by 50 to 80% immediate post burn.
- Reduce post settlement overstory trees by 40 to 70% within 2 years post burn.
- Achieve mortality in understory trees and shrubs by 50 to 80% within 1 year.
- Increase native grass and forb cover within 5 years postburn.

Tree Mortality, Loss of Snags and Downed Logs**:**

In response to resource management objectives:
< 5% old growth ponderosa pine mortality
< 50% reduction of snags >20"
< 80% reduction of downed logs >20"

Pinyon Juniper

- Reduce density of Juniper by 60 to 80% immediate post treatment
- Reduce pinyon 60 to 80% in all size classes less than 12" diameter at groundline immediate post treatment
- Increase relative cover of native grasses and forbs by 50-70% within 5 years post treatment

Tamarisk

- Achieve 95 to 100% mortality after the initial treatment
- Conduct burning to remove the salt infested duff layer that accumulates in tamarisk stands. This duff layer inhibits desirable plant recovery
- Apply herbicide to tamarisk re-sprouts after burning. This is the most effective method of controlling large thickets of tamarisk

Tamarisk is an extremely aggressive alien plant species that invades riparian areas throughout the Western United States. Mechanical control methods using chainsaws or heavy equipment are often not feasible due to labor costs and the inaccessibility of the site. Both of the mechanical alternatives also require the use of fire to burn the slash left after removal..

Overall Strategies:

- Achieve resource objectives such as reduction of juniper and shrub encroachment.
- Improve watershed by increasing herbaceous cover, which will reduce soil erosion.
- Increase native plant diversity and reduce occurrence of non-native species.
- Implement hazard fuel reduction burns around suppression zones to reduce intensity of subsequent unwanted wildland fires.
- Restore fire as an ecological process in the Shivwits Unit, FMU3.
- Monitor hazardous fuels treatment program to assess success.
- Cooperatively manage wildland fires across the mutual boundary's with the Grand Canyon National Park; Grand Canyon-Parashant National Monument; BLM Las Vegas, Phoenix, Kingman, and Arizona Strip Field Offices; Valley of Fire State Park, Clark County, Nevada, Mojave County, Arizona; Henderson, Boulder City, Laughlin, Overton, and Logandale, Nevada; and, Meadview, Arizona.

Goal: Reduce wildland fire hazard around developed areas, along interface boundary areas and adjacent to cultural and historic sites.

Objective: Ensure fire does not destroy any administrative structure, nor incur costly damage (rehabilitation costs greater than $10,000) to any cultural or historic site.

Strategies:

- Apply hazard fuel reduction around suppression zones to reduce fire intensity and severity to lesser levels.
- Apply hazard fuel reduction around vulnerable cultural and historic sites for protection from fire damage

Table 2. Description of Alternatives

Alternative A **No Action** **(Continue Current Management)**	**Alternative B** **Full Suppression**	**Alternative C** **Wildland Fire Use and Full Suppression** **Management Preferred Alternative** ***The Environmentally Preferred Alternative***
Under this alternative, the fire management program would utilize suppression, wildland fire use, prescribed fire, and mechanical hazard fuel reduction. Existing fire management units (FMUs) as designated in the Lake Mead NRA 1997 Prescribed Natural Fire Plan, would remain within Lake Mead NRA and would include suppression zones, wildland fire use zones, and resource restoration through the use of prescribed fire. The low desert area would remain designated as a full suppression zone. A wildland fire use program would continue on portions of the Shivwits Plateau area of the Parashant NM. Initial attack suppression actions would be taken on all human-caused wildland fires. Suppression actions would be taken on all escaped prescribed fires, and lightning-caused fires that are within the suppression units would be suppressed.	Under this alternative all ignitions, whether of natural origin or human-caused, would be suppressed. Suppression would be accomplished through the use of confinement, containment, or control tactics. Control objectives would seek to limit fire spread as quickly as possible, while ensuring public and firefighter safety, protecting the cultural, natural, and historic resources, and minimizing costs.	Under this alternative, three fire management units (FMU) would be designated within Lake Mead NRA and Parashant NM: 1. Interface (FMU1); 2. Desert below 6,000 feet (FMU2); and, 3. Shivwits Plateau (FMU3). Lake Mead NRA and Parashant NM FMU's are differentiated by management objectives, fuels, political boundaries, and values-to-be-protected. Initial attack suppression actions would be taken on all human-caused wildland fires. Suppression actions would be taken on all escaped prescribed fires, and lightning-caused fires that are within the suppression units would be suppressed. This alternative is similar to the management under the No Action Alternative. However, it differs from Alternative A in that it establishes management goals for the interface portions of the recreation area.

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SECTION II: DESCRIPTION OF ALTERNATIVES

INTRODUCTION

This chapter describes the alternatives considered, including the no action alternative, which is the continuation of the current management practices. The alternatives described include mitigation measures proposed to minimize or avoid environmental impacts, as well as monitoring activities. This chapter also describes alternatives considered but eliminated from further study, and provides reasons for their dismissal.

ACTIONS COMMON TO ALL ALTERNATIVES

Under all alternatives, initial attack suppression actions would be taken on all human-caused wildland fires. Suppression actions would also be taken on all escaped prescribed fires, and lightning-caused fires that are within or threaten the suppression units. Initial attack suppression actions would provide for public and firefighter safety, protect public and private resources, and utilize techniques that are least damaging to the natural, cultural, and historic resources. Dozers and other heavy equipment would be used only with superintendent approval, unless life or property is threatened. Standard tactics that would be utilized include deployment of fire engines and ground personnel with handtools.

In undeveloped areas throughout the recreation area, use of suppression resources would be constrained as follows:

- Fire engines would not be driven off paved or unpaved roadways.
- Use of airtankers and helicopters would occur only when life, historic or cultural resources, private property, or threatened and endangered species habitat (i.e. tortoise) are threatened.
- Handtools and chainsaws would be used considering the minimum impact (vegetation cutting and fireline scraping) necessary to stop the spread of the fire.

Alternative A - No Action: Continue with Current Management

Under this alternative, current management of fires would continue as directed under the *Lake Mead NRA Prescribed Natural Fire Plan* (1997). The fire management program would utilize suppression, wildland fire use, prescribed fire, and mechanical hazard fuel reduction. Existing fire management units (FMUs) as designated in the *Lake Mead NRA 1997 Prescribed Natural Fire Plan*, would remain in place within the recreation area and would include suppression zones in the entire low desert region, and wildland fire use and suppression zones on the Shivwits Plateau portion of the recreation area (Figures 3, 4, and 5).

The designations are based on vegetative communities, fuel types, geographical barriers, and administrative boundaries. They are related to the protection of life and property, administrative structures, range improvements related to grazing management, and historic structures and cultural sites.

Figure 3. Existing Fire Management Units, Shivwits Plateau

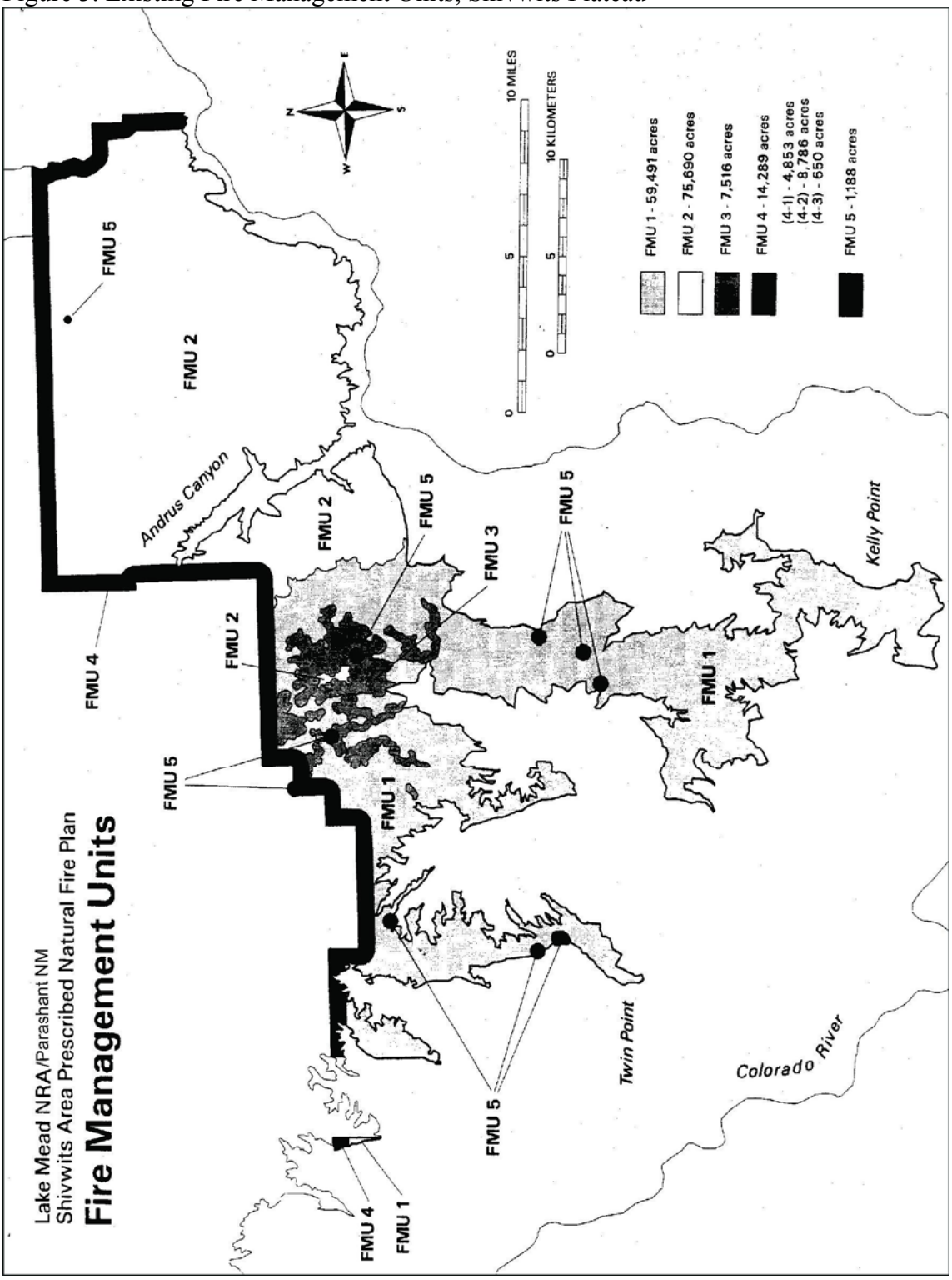


Figure 4. FMU 3, Shivwits Plateau

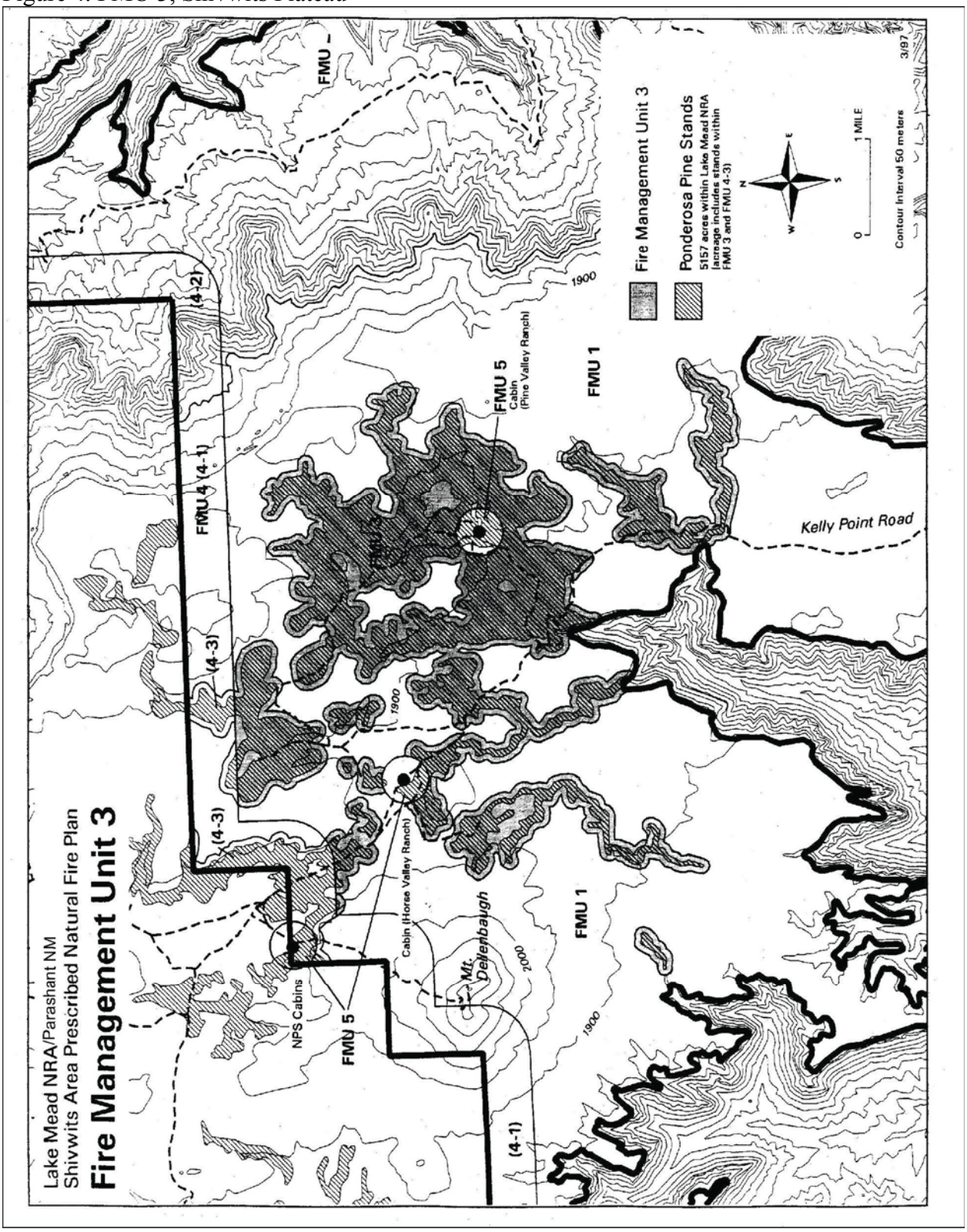
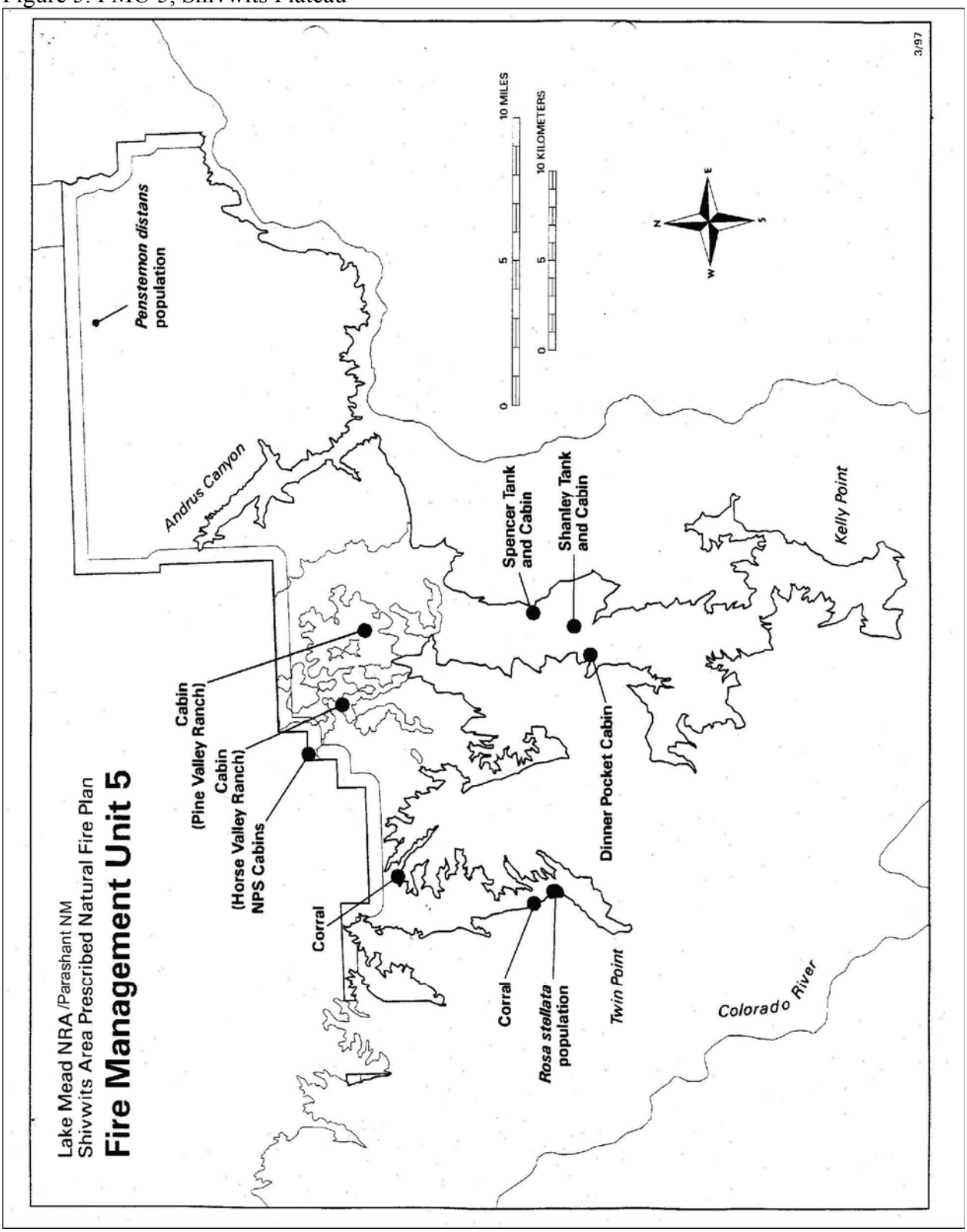


Figure 5. FMU 5, Shivwits Plateau



Initial attack suppression actions would be taken on all human-caused wildland fires. Suppression actions would be taken on escaped prescribed fires, and lightning-caused fires that are within the suppression zones.

A wildland fire use program would continue on portions of the Shivwits Plateau area of Parashant NM. Lightning-caused fires occurring in the wildland fire use zone would receive appropriate management responses utilizing prescription control objectives that consider potential benefits to the natural and cultural resources that may occur as a result of the fire. Prescription control objectives would be based on current and predicted weather parameters that would ensure that the fire stays within a delineated area within the recreation area, does not damage historic or cultural properties, does not threaten life or property, and results in positive strides towards the natural resource management objectives. Suppression would occur for fires not meeting these objectives. Suppression zones would be designated on the Shivwits Plateau based on the protection of cultural and historic properties, riparian and spring areas, rare plant habitat, and potential and existing habitat for sensitive, threatened, and endangered species.

The full suppression zone would remain in place throughout the entire lower elevations of Lake Mead NRA. Within this zone, all ignitions, whether human-caused or of natural origin, would be suppressed using the appropriate management response with control objectives. Control objectives seek to limit fire spread as quickly as possible, while ensuring public and firefighter safety, the protection of natural, cultural, and historic resources, and minimizing costs. High priority would be given to wildland fires that have the potential to spread onto private lands

In most cases, the appropriate management response with control objectives would entail rapid assignment of firefighters with hand tools and/or engines to contain and control the fire as rapidly as possible. In some cases, the fire may be contained to a single tree or small area of vegetation that is completely encircled by rock or bare soil. In those situations, after careful evaluation by a qualified initial attack incident commander, the appropriate management response could be monitoring the fire until the fire burns itself out.

Prescribed fires, or fires intentionally set to achieve specific management objectives, would be used for the purposes of implementing resource management priorities, for the removal of non-native vegetation such as tamarisk, for the reduction of hazardous fuel accumulation, and for research purposes. Prescribed fires would occur primarily in areas with dense stands of tamarisk where no other control is feasible. An adaptive management program would remain in place on the Shivwits Plateau, as described in the vegetation treatment and hazard fuel reduction plan (Appendix A). The goal of this program is to reduce dense stands of pinyon-juniper and replace them with a mosaic type community with patches of burned and unburned vegetation, and to restore the ponderosa pine forests. In addition, prescribed fires may be used to reduce hazardous fuels around historic or cultural resources, administrative structures, and sensitive areas to provide a defensible space, which would increase the potential for protection should a wildland fire occur.

The five-year plan lists the expected treatment areas by year. It is expected that prescribed fire and restoration thinning would be used to treat over 15,000 acres in the next five years. It is possible that prescribed fires would not occur, even if scheduled, due unfavorable weather,

staffing shortfalls, or as a result of new information. Prescribed fires would only be used when the prescription criteria, including weather, specific control and holding forces, geographical perimeter, firing techniques, and timing, are met.

Mechanical hazard fuel reduction would be utilized in conjunction with the prescribed fire program, or as the sole method for reducing hazardous fuels, depending on the location and risk factors. Mechanical hazard fuel reduction would be utilized in the developed areas, campgrounds, and where appropriate around historic structures.

Prescribed fire would be utilized in conjunction with herbicide treatment in specific riparian areas within the recreation area for the purpose of controlling non-native tamarisk and the restoration of native riparian vegetation. Using prescribed fire to assist in the control of tamarisk has been a very effective and efficient method for managing moderate to large size stands of dense monotypic tamarisk. Tamarisk re-sprouts vigorously from the base of the root crown within a few weeks following fire, however these re-sprouts readily uptake herbicide directly applied by using the low-volume basal spray method. The low-volume basal spray treatment with herbicide is a very selective method that does not affect surrounding desirable vegetation. We have consistently achieved 90 to 98% mortality of tamarisk by applying herbicide to the re-sprouts following a prescribed burn. Using prescribed fire to control tamarisk also greatly reduces the amount of labor in comparison with using chainsaw crews to cut individual stems and then treating the stumps with herbicide and then having to burn the left over slash piles created by the cutting operation. Additional benefits of burning tamarisk removes the dense above ground bio-mass and the salt laden litter and duff layer underneath tamarisk stands. The removal of this standing bio-mass, litter and duff layer opens up the area to allow for native plant recovery to occur. The tamarisk duff and litter layer if not burned or removed will inhibit native plant recovery.

Alternative B - Implement Full Suppression Program

Under this alternative all ignitions, whether of natural origin or human-caused, would be suppressed. Suppression would be accomplished through the use of confinement, containment, or control tactics. Control objectives would seek to limit fire spread as quickly as possible, while ensuring public and firefighter safety, protecting the cultural, natural, and historic resources, and minimizing costs.

In most cases, an appropriate management response with control objectives would entail rapid assignment of firefighters with hand tools and/or engines to contain and control the fire as rapidly as possible. In some cases, the fire may be contained to a single tree, shrub, or small area of vegetation which is completely surrounded by bare soils or rock. In these situations, after evaluation by a qualified initial attack incident commander, the appropriate management response could be monitoring the fire until it burns itself out.

Vegetative treatment, such as prescribed burns, or fires intentionally set to achieve specific management objectives, would be carried out as in Alternative A. Tamarisk control in riparian areas, as described in Alternative A, would also be continued within the recreation area.

Alternative C (Management Preferred/Environmentally Preferred Alternative): Establishment of Fire Management Units to Allow a Combination of Wildland Fire Use and Suppression

Under this alternative, three FMUs would be designated within Lake Mead NRA (Figure 6 through 10): 1. Interface (FMU1); 2. Desert below 6,000 feet (FMU2); and, 3. Shivwits Plateau (FMU3). Lake Mead NRA and Parashant NM FMUs are differentiated by management objectives, fuels, political boundaries, and values-to-be-protected.

1. Interface FMU

Interface FMU physical description

This FMU has 23 separate interface areas that encompass residential areas, recreational trailer villages, commercial buildings, administrative sites and developed campgrounds, that are within or directly adjacent to the Lake Mead NRA boundary (Figures 6, 7, 8, and 9). These areas are described in the affected environment section. The Interface FMU suppression strategy would match that of the shared boundary administrator, be it federal, state, county or local. The suppression response will be identified in Annual Operating Plans that are in accordance with an approved agreement (Master, MOU, Mutual Aid, other).

Interface FMU Strategic Management Objectives

Within this FMU, all wildland fires would be suppressed using an appropriate management response with the intent of minimizing loss of structures and property. The first priority during these suppression actions would be the safety of personnel and the public, including adjacent landowners.

Management of the Interface FMU is designed to meet the following objectives:

- All fire management activities would have as the highest priority firefighter and public safety.
- Appropriate management responses for all wildland fires (regardless of ignition source) would be rapid containment and suppression to protect the public, check fire spread onto private property, and protect the natural, cultural and historic resources of the recreation area.
- Emphasis would be placed on facilitating reciprocal fire management activities through the development and maintenance of cooperative agreements and working relationships with pertinent fire management entities.
- Hazard fuel reduction would be given high priority in this FMU in and around developed areas, along the interface boundary, and adjacent to cultural and historic sites.
- Mechanical hazard fuel reduction techniques would be applied around suppression zones to reduce fire intensity and severity to lesser levels. This could be the first step in a fuels reduction program followed by prescribed fire.
- Mechanical hazard fuel reduction would be applied around vulnerable cultural and historic sites for protection from fire damage.

Figure 6. FMUs Lake Mohave

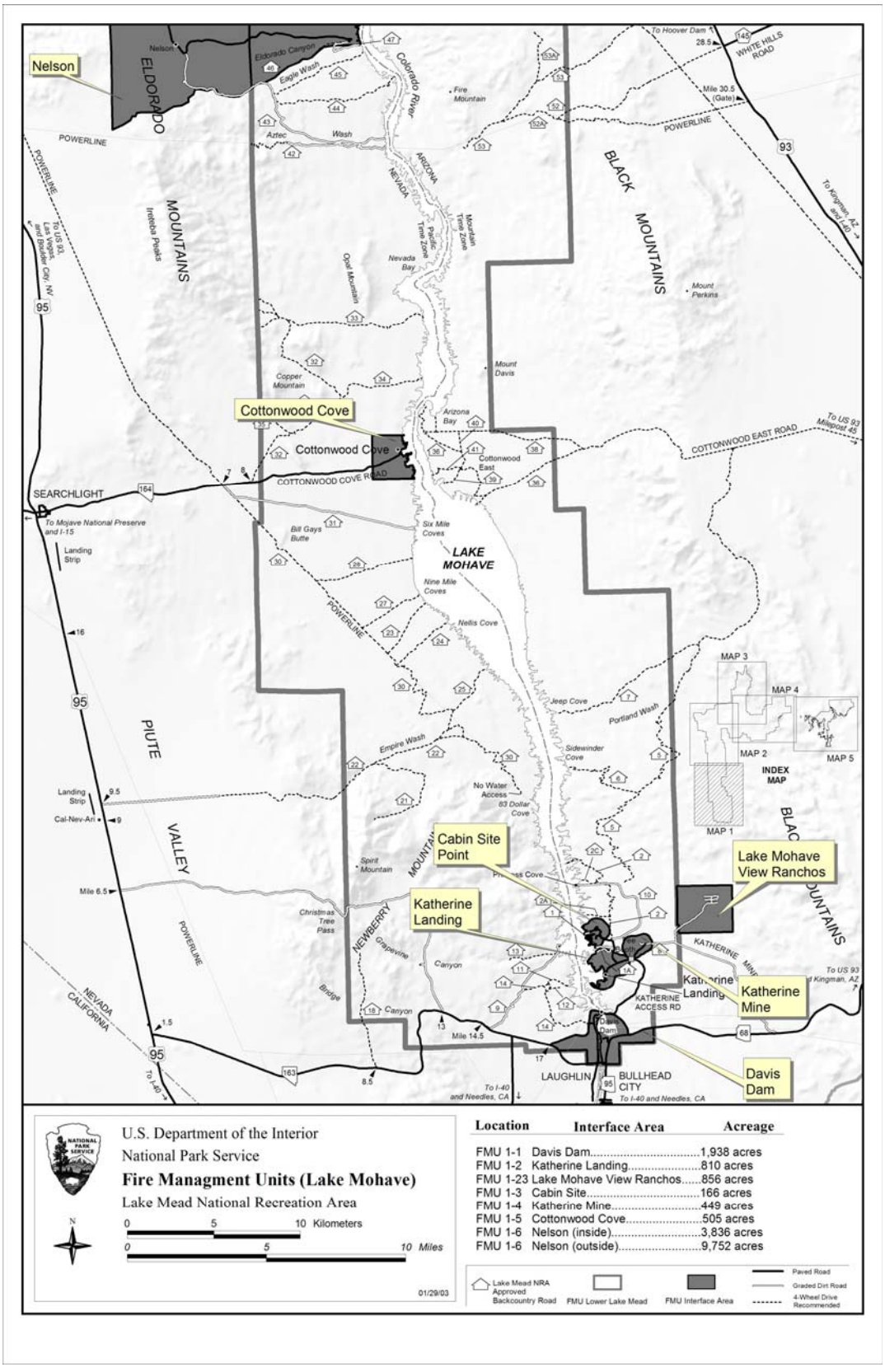


Figure 7. FMUs Hoover Dam Area

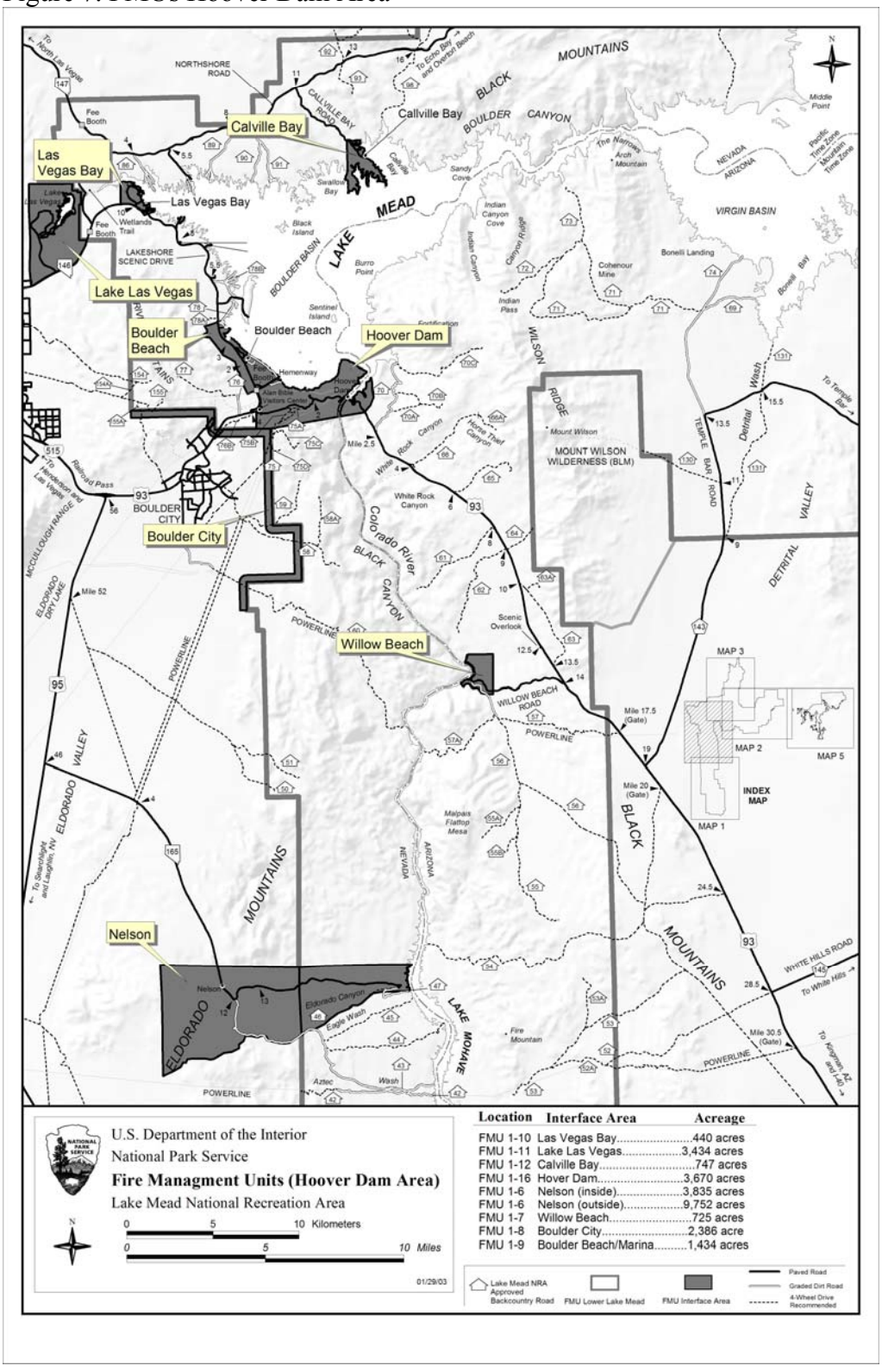


Figure 8. FMUs Overton Arm Area

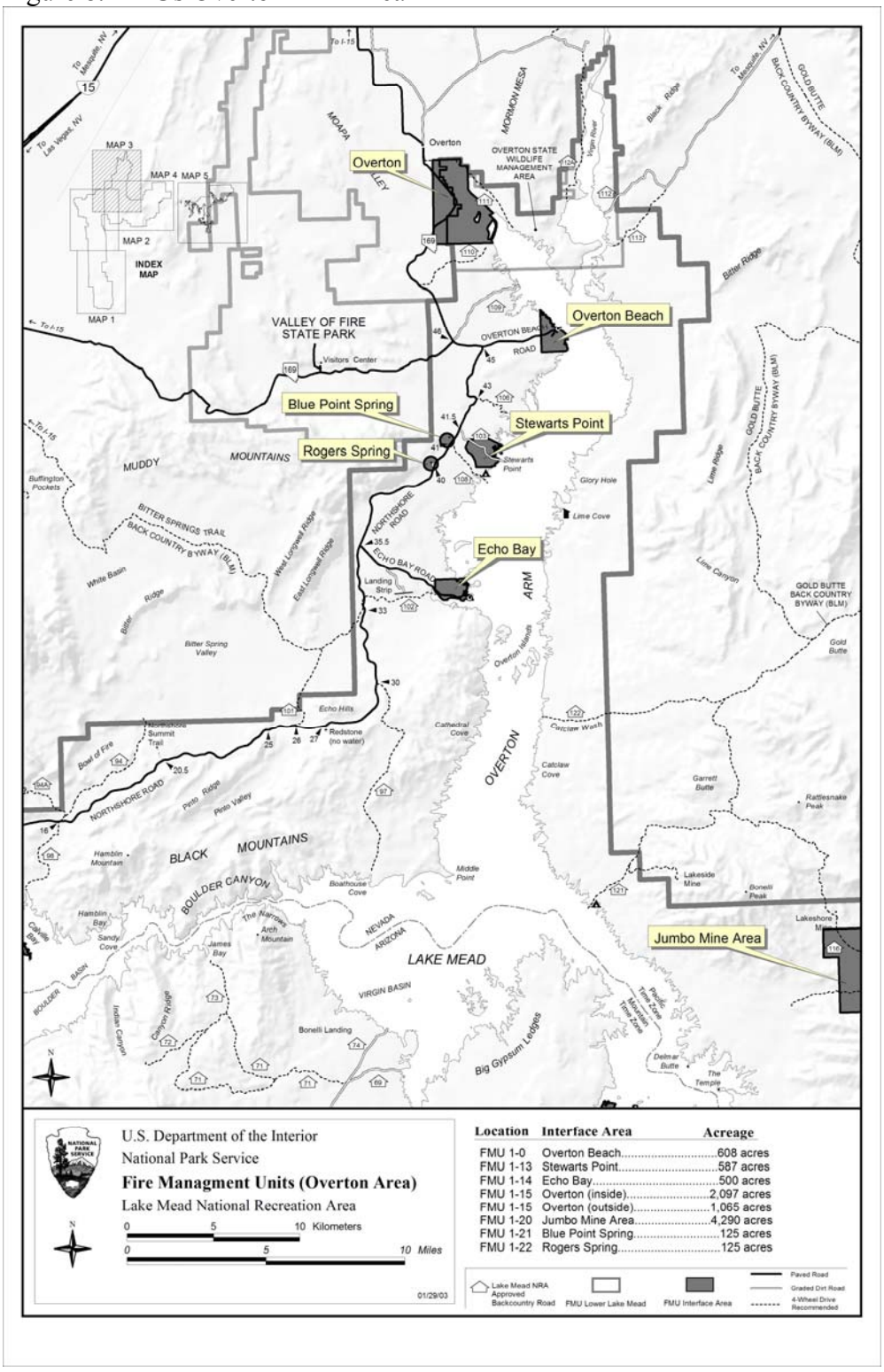
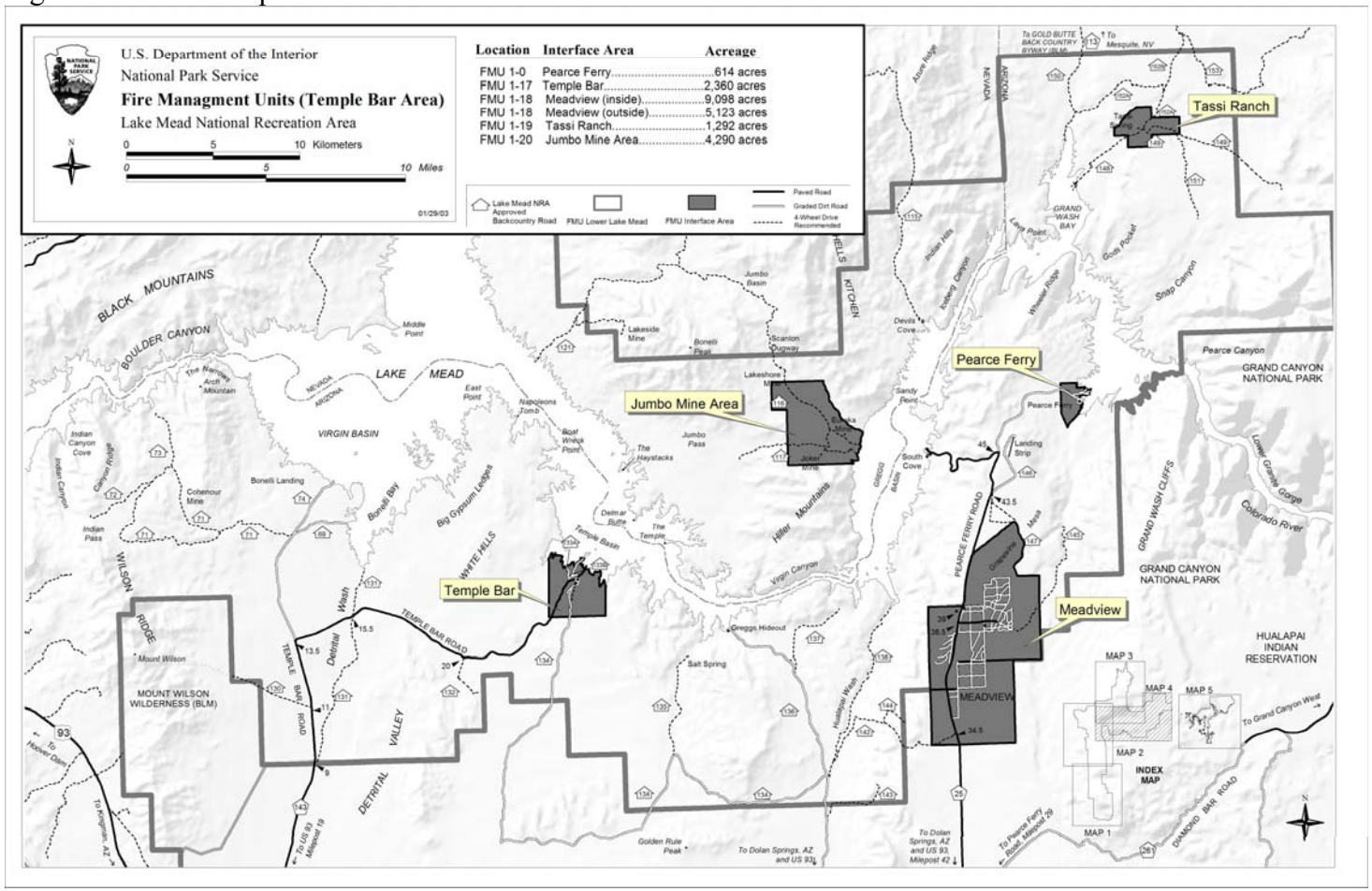


Figure 9. FMUs Temple Bar Area



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- Prescribed fires in the Interface FMU would be accomplished during periods of time or under a prescription that minimizes escape possibilities. If fuel loadings are high enough to make control of the burn difficult then a two-stage process would be considered, such as mechanical treatment then prescribed burning.
- Prescribed fire and mechanical treatment would be used to reduce hazard fuel build-ups that occur in the Interface FMU facilitating protection of values at risk.
- Strong interagency fire and emergency service agency participation would be encouraged within this FMU. Interaction with adjacent landowners through Lake Mead NRA participation in prevention programs and mutual hazard fuels reduction projects would be encouraged.

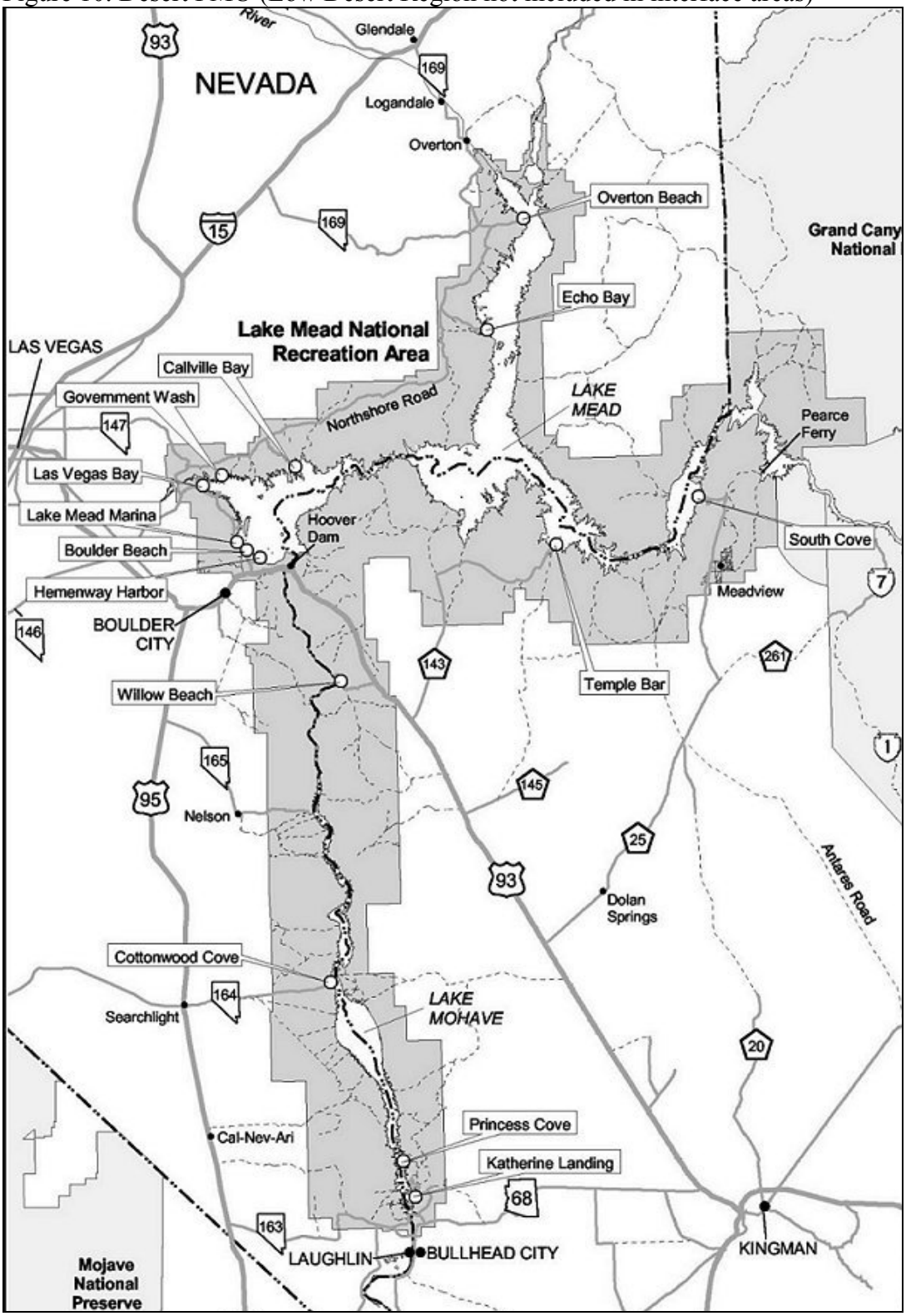
Interface FMU Management Constraints and Mitigation

- Smoke management reporting procedures for burning in Nevada/Arizona would be followed for all prescribed fire operations.
- Minimum impact tactics would be employed.
- Off-road vehicle use would be prohibited unless approved by the superintendent.
- Dozers or graders would not be used unless approved by the superintendent.
- Protection mitigation measures for known historic and cultural resource sites in or near the project area would be assured before a prescribed burn project is initiated.
- Chainsaw use would be approved by the superintendent.
- Low level aircraft use and retardant would be approved by the superintendent and may be disallowed if sensitive, threatened, or endangered bird species are near the site.
- All fire management activities would consider safety of personnel and the public as the highest priority.
- Recreation area neighbors, park visitors and the local residents would be notified of all planned and unplanned fire management activities that have the potential to impact them.
- All park closures would be at the discretion of the superintendent.
- No fire management operations would be initiated until all personnel involved receive a safety briefing describing known hazards and mitigating actions (LCES), current fire season conditions and current and predicted fire weather and behavior.
- Fire management operations would be carried out by qualified individuals that promote the safe and skillful application of fire management strategies and techniques.

2. Desert FMU

This FMU was mainly established to encompass the desert tortoise habitat (Figure 10). Desert tortoises prefer desert shrub areas such as creosote bush scrub on flats and on slopes up to 5000 feet. Also occurring in this FMU are areas with stands of tamarisk. Tamarisk is a non-native invasive plant that is displacing the native riparian plants. This FMU would be divided into two zones. A desert habitat zone and a tamarisk zone. Tamarisk control would be the same as described under Alternative A.

Figure 10. Desert FMU (Low Desert Region not included in interface areas)



Desert FMU Strategic Management Objectives

A. Desert Habitat Zone

- Personnel and public safety would be the highest priority for all fire management activities.
- All wildfires would be suppressed.
- The effects of fire on the ecosystem would be monitored.
- Fire management operations would be carried out by qualified individuals that promote the safe and skillful application of fire management strategies and techniques.

B. Tamarisk Zone

- Personnel and public safety would be the highest priority for all fire management activities.
- Prescribed fires would be conducted in the tamarisk habitat to achieve resource management objectives.
- A herbicide treatment would follow the prescribed burns.
- The effects of fire on the ecosystem would be monitored.
- Fire management operations would be carried out by qualified individuals that promote the safe and skillful application of fire management strategies and techniques.

Desert FMU Management Constraints and Mitigation

A. Desert Habitat Zone

- No fire management operations would be initiated until all personnel involved receive a safety briefing describing known hazards and mitigating actions, current fire season conditions and current and predicted fire weather and behavior.
- All fire management activities would consider safety of personnel and public as the highest priority.
- Fire management operations would be carried out by qualified individuals that promote the safe and skillful application of fire management strategies and techniques.
- Fire management activities would employ minimum impact tactics.
- The minimum tool analysis would be utilized when determining the appropriate response.
- Off-road vehicle use would be prohibited unless approved by the superintendent.
- Dozer or grader use would be prohibited unless approved by the superintendent.
- Fires located in wilderness or potential wilderness will be immediately reported to the Wilderness Coordinator. An aircraft use document will need to be completed and signed by the Superintendent and made part of the fire package if the Incident Commander determines that aerial resources are required.

B. Tamarisk Zone

- No fire management operations would be initiated until all personnel involved receive a safety briefing describing known hazards and mitigating actions, current fire season conditions and current and predicted fire weather and behavior.

- All fire management activities would consider safety of personnel and public as the highest priority.
- Fire management operations would be carried out by qualified individuals that promote the safe and skillful application of fire management strategies and techniques.
- Smoke management reporting procedures for burning in Nevada/Arizona would be followed for all prescribed fire operations.
- Fire management activities would employ minimum impact tactics.
- Off-road vehicle use would be prohibited unless approved by the superintendent.
- Dozer or grader use would be prohibited unless approved by the superintendent.
- Protection mitigation measures for known historic and cultural resource sites in or near the project area would be assured before a prescribed burn project is initiated.

Control Problems

Lower lake levels are increasing tamarisk and other vegetative growth. The Muddy River and Virgin River areas have particularly heavy/continuous stands of tamarisk that pose a risk to fire spread.

In most other areas there should be no control problems due to lack of fuels and surrounding terrain. Years of high rainfall could create an accumulation of grasses, which could carry a fire, but control still should not be a problem. For fires located on the Newberry Mountain Range, indirect attacks by aerial support would be used as much as possible due to the extreme terrain and the goal of firefighter safety. A resource advisor would be present in this area due to the significance of the site to Native Americans.

Desert FMU Values to be Protected and Special Concerns

Sensitive, threatened, and endangered flora and fauna, and their habitat, are of special concern within these zones.

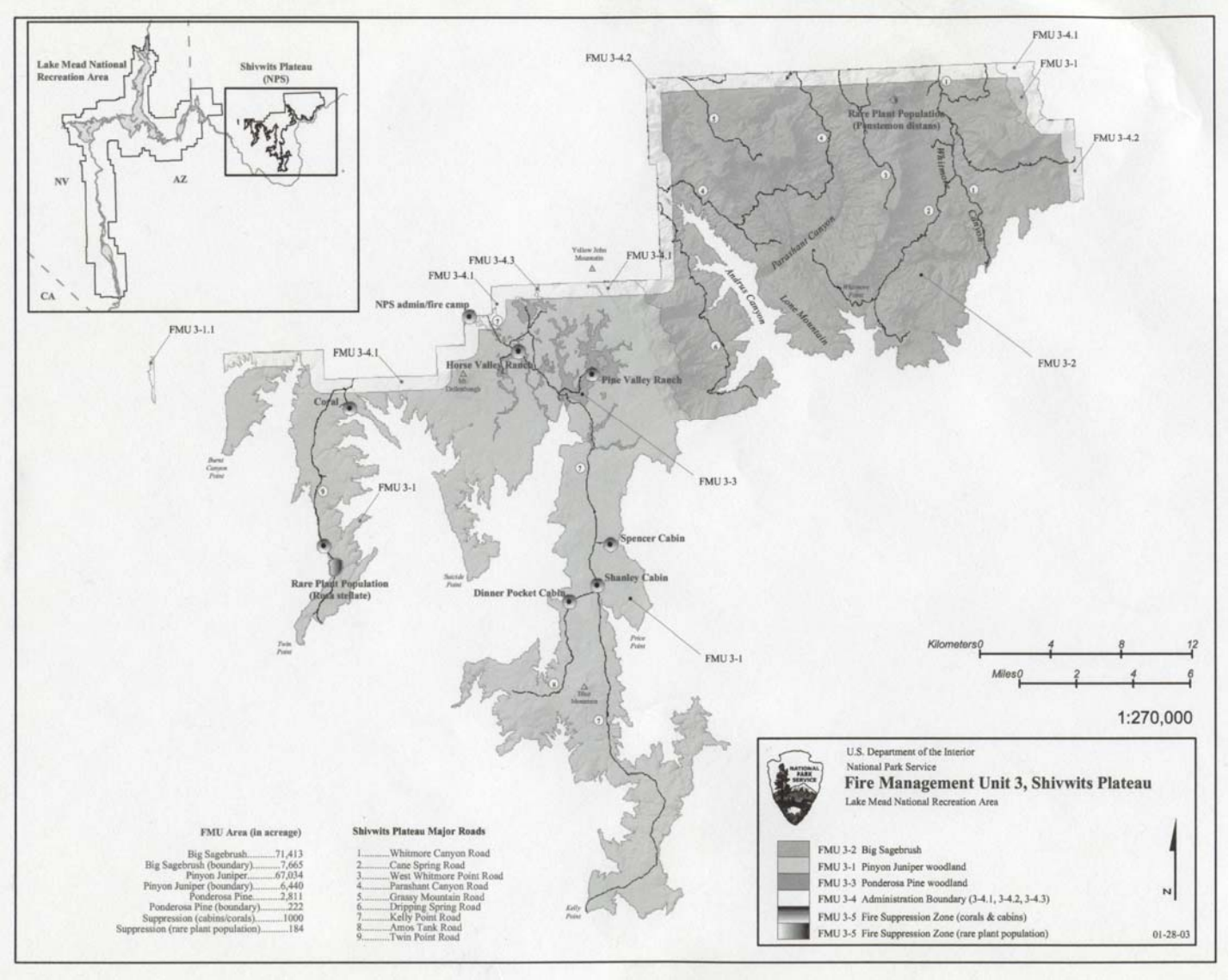
- Any known threatened, endangered, or sensitive species sites would be acknowledged and mitigated for during prescribed burn operations as well as fire suppression actions.
- All known archeological, cultural sites and ethnographic resources would be mitigated for in all fire management activities.

3. Shivwits FMU

Shivwits FMU Physical Description

This FMU is an extremely remote area within the Arizona Strip located on the northwest rim of the Grand Canyon (Figure 11). The nearest community is St. George, Utah, which lies 90 miles to the north. Most of the area is without roads; access to the area is via unpaved dirt roads with varying road conditions. Most of the northern boundary is adjacent to BLM administered lands and the southern and eastern boundaries are adjacent to Grand Canyon NP. The area is part of Grand Canyon-Parashant NM, but is still managed under the direction of the NPS at Lake Mead NRA.

Figure 11. FMUs Shivwits Plateau



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There are three main habitat types on the Shivwits Plateau: including pinyon-juniper, ponderosa pine, and sagebrush. There are several administrative sites, historical sites, and two special plant populations that would receive full suppression. This is also an area with numerous historic and cultural resources. Any prescribed fire or fire for resource benefit would receive an evaluation from a resource advisor.

Shivwits FMU Strategic Management Objectives

- Personnel and public safety would be the highest priority for all fire management activities.
- All human-caused wildfires would be suppressed.
- Fire for resource benefit would be an option as well as prescribed burning to meet resource objectives.
- The effects of fire on the ecosystem would be monitored.
- Fire management operations would be carried out by qualified individuals that promote the safe and skillful application of fire management strategies and techniques.
- The Mt. Trumbell ponderosa pine research and other widely recognized sources of ponderosa pine restoration information would be utilized and adapted to the situation.

Shivwits FMU Management Constraints and Mitigation

- No fire management operations would be initiated until all personnel involved receive a safety briefing describing known hazards and mitigating actions, current fire season conditions and current and predicted fire weather and behavior.
- All fire management activities would consider safety of personnel and public as the highest priority.
- Fire management operations would be carried out by qualified individuals that promote the safe and skillful application of fire management strategies and techniques.
- Fire management activities would employ minimum impact tactics.
- The minimum tool analysis would be utilized when determining the appropriate response.
- Off-road vehicle use would be prohibited unless approved by the superintendent.
- Dozer or grader use would be prohibited unless approved by the superintendent.
- Smoke management reporting procedures for burning in Arizona would be followed for all prescribed and fire use operations
- Protection mitigation measures for known historic and cultural resource sites in or near the project area would be assured before a prescribed burn project is initiated or a fire for resource benefit is allowed to burn.
- Fires located in wilderness or potential wilderness will be immediately reported to the Wilderness Coordinator. An aircraft use document will need to be completed and made part of the fire package if the Incident Commander and superintendent determine that aerial resources are required.

Control Problems

Fire control is usually very simple due to sparse surface fuels in the primary cover type of pinyon juniper. In the pinyon-juniper areas extreme weather conditions (high winds) are needed to create a large fire due to the lack of fine fuels. The ponderosa pine stands have a more continuous fuel bed but are surrounded on most sides by pinyon juniper, except on a few

northern boundary areas. Control efforts require a more speedy response in the ponderosa type if the fire is determined to be a threat to resource values.

Shivwits FMU Values to be Protected and Special Concerns
Sensitive, threatened, and endangered flora and fauna, and their habitat are of special concern, as are cultural resources.

- Any known sensitive, threatened and endangered species sites would be acknowledged and mitigated for during prescribed burn operations as well as fire suppression actions.
- All known archeological and cultural sites would be mitigated for in all fire management activities.

Costs
Every year millions of dollars are spent suppressing wildfires. In remote areas such as the Shivwits region, it is typical to use aerial attack for suppression, which is the most costly form of fire suppression. A Wildland Fire Use program would reduce the cost associated with fire management because suppression actions would be reduced, aerial attacks would be less frequent, and a minimal type approach, with small crews and aerial reconnaissance for fire monitoring, would be used. However, projects of long duration could be costly, depending upon the acreage and fire duration.

MITIGATION AND MONITORING
Mitigation measures are specific actions that when implemented reduce impacts, protect park resources, and protect visitors. General mitigation for all methods is described first. Where appropriate, further mitigation is described under mitigation for suppression activities, mitigation for wildland fire use, or mitigation for treatment activities, including prescribed fire and hazard fuel reduction activities.

Soils
No off-road vehicle use or bulldozer use would be permitted unless specifically authorized by the superintendent. Suppression activities would utilize minimum impact suppression tactics where possible. To protect the soils in the recreation area, fire lines and other soil scars would be restored after the completion of suppression activities.

Mitigation for treatment activities: A soil monitoring program may be initiated in cooperation with USGS to determine the effects of the treatment activities, or lack of activities, on soil erosion. Treatment methods would be re-evaluated based on the findings of the monitoring program.

Vegetation
All areas with rare plants would be mapped and designated as non-treatment units. Full suppression tactics would be used to protect these areas.

Areas identified as problem areas for non-native plants would be mapped and designated as full suppression zones, except tamarisk areas. To protect the region from the spread of non-native

plants, no personnel or equipment would be permitted in the designated non-native plants problem areas, except in emergency situations.

Fire crews would be dispatched to construct control lines around snags, old growth trees, and large down logs.

Restoration and seeding activities may occur in wildland fire areas (FMU 3), or areas in the low desert where fire burns prior to suppression (FMU 2). In these circumstances, the NPS restoration specialist and/or burned area rehabilitation team would be consulted to determine the best native seeding for the burned area. Vegetation treatment and seeding activities would be monitored and evaluated on an annual basis.

Seeding activities could also occur in the wildland fire use zones. Seeding guidelines are outlined in Appendix F.

Vegetation plots, photo monitoring, and observations will be compiled for analysis to determine treatment effectiveness. Adaptive management principles will be applied throughout all phases of restoration treatments.

Mitigation for treatment activities: Treatment units would be surveyed prior to any activities to look for rare plants and non-native species. Areas identified as problem areas for non-native plants would be mapped and designated as suppression zones. To protect the region from the spread of non-native plants, no personnel or equipment would be permitted in the designated non-native plant problem areas, except where authorized by resource project monitors.

Thinning would occur in portions of the ponderosa pine treatment areas and pinyon-juniper areas, and only post-settlement trees would be designated for thinning. Cut trees could be removed,or burned in place from ponderosa pine treatment areas to reduce the potential for hazard fuel accumulation. Resource specialists and prescribed fire specialists will determine when removal of the cut trees is appropriate.

Wildlife

Surveys would be conducted on potential nesting cavities and all areas where nesting sites are found would be protected through the designation as suppression zones and no treatment would occur. Maps of existing sites and habitat would also be consulted when making decisions and designating suppression or non-treatment zones.

A resource management specialist would be present for suppression, wildlife fire use, and treatment activities. Appropriate suppression activities would take place if biologists determine that a fire would adversely impact wildlife habitat.

Threatened, Endangered, and Sensitive Species

Maps of existing and potential habitat would be consulted when planning and implementing the fire management activities. Suppression and non-treatment zones would be designated around potential and known habitat for threatened, endangered, and sensitive species. Surveys would

continue in the region as directed by the NPS wildlife biologists. If more potential habitat is designated, these areas would also be designated as non-treatment zones

Desert tortoise mitigation for suppression activities is detailed in *Fighting Wildfire In Desert Tortoise Habitat: Considerations For Land Manager* (Duck et al.) and refined in Appendix A of that document*, A Hierarchy for Fire Suppression Activities in Desert Tortoise Habitats.* This has been adopted by managers throughout desert tortoise habitat, and would be adopted in the fire management plan. That document is found in Appendix G.

On the Shivwits Plateau, surveys would be conducted for Mexican spotted owls and northern goshawk. The potential Mexican spotted owl habitat in the Shivwits region is classified by NPS wildlife biologists as dispersal areas or migrating habitat, rather than breeding areas. Preliminary surveys by NPS wildlife biologists found no Mexican spotted owls. Follow-up two-year surveys are planned starting in 2002 in accordance with U.S. Fish and Wildlife Service protocol. The survey areas will be focused on ponderosa pine stands, slot canyons, and riparian zones. If Mexican spotted owls are found, all vegetation treatment operations in that area will be halted and further consultations with the U.S. Fish and Wildlife Service will be initiated.

Surveys for northern goshawks would be conducted in all areas in which fire activities are planned, and no activity would occur in areas where goshawks are nesting. Goshawks have a lengthy nesting period. Courtship and nest-building may begin as early as two months before egg-laying. After eggs are laid, the incubation period is 5 to 6 weeks. Once the young birds have hatched, they remain in the nest for another 5 to 6 weeks and do not attain complete independence from the parents until they are approximately 80 days old. As a result, the sensitive period for breeding goshawks extends from early March through September. Any burning scheduled for this period would be preceded by a goshawk survey. Goshawk surveys would be coordinated through the Wildlife Branch of the Resource Management Division, Lake Mead NRA. If goshawks are discovered in an area proposed for burning, fire managers would consult with the park's wildlife biologists to determine an acceptable course of action, which may include delaying the burn schedule or altering the location of the proposed burn

Potential habitat for the California condor exists in the region, and biologists tracking the condors have reported them nearby. If condors are found inhabiting portions of the Shivwits region, those areas would be designated as non-treatment zones. In addition, the following mitigation measures would be adopted specifically for the protection of the California condor.

If condors occur in the action area during mechanical treatment operations, activities within 300 feet of the bird would cease until it leaves on its own or until techniques are employed by permitted personnel which result in the individual leaving the area.

- All on-site personnel would be informed to avoid interacting with condors and immediately contact the NPS wildlife biologist or resource staff so they can inform the U.S. Fish and Wildlife Service or Peregrine Fund personnel.

- The Lake Mead NRA fluid leakage and spill plan would be followed at all times.

- Open water sources such as "pumpkin" inflatable water storage tanks would be covered when not in use.

- If condors are located near the project area, weather conditions would be evaluated by Prescribed Fire Specialists and Resource Advisors to determine the potential for impacts from smoke on the condors. Prescribed fire would be cancelled if weather conditions increase the impacts of smoke on condors.

Habitat for the Southwestern willow flycatcher, Yuma clapper rail, and relict leopard frog could exist in tamarisk control areas in the spring riparian areas.

The tamarisk treatments occur in small isolated patches (1 to 5 acres) associated with springs that form narrow thickets usually only one tree width along linear stream courses. Most if not all of the tamarisk prescribed burn treatment sites occur within areas that have no potential breeding habitat for Southwestern willow flycatchers according to the habitat guidelines referenced in Sogge, Marshall, Sferra and Tibbitts Technical Report (NPS/NAUCPRS/NRTR-97/12 A Southwestern Willow Flycatcher Natural History Summary and Survey Protocal, May 1997). However this determination is still evaluated on a case by case basis of each treatment site prior to implementing a prescribed burn tamarisk control project.

The Southwestern willow flycatcher and Yuma clapper rail would be protected from treatment activities. Surveys in accordance with U.S. Fish and Wildlife Service protocol would occur for Southwestern willow flycatchers prior to any treatment activities. Surveys would also occur for the Yuma clapper rail in suitable habitat. If nests or these species are found, these areas would be designated as non-treatment sites.

Treatment would include planting native riparian vegetation to restore the springs. Spring restoration would improve habitat for Southwestern willow flycatchers and other riparian bird species.

The relict leopard frog exists in several springs around Lake Mead NRA. Extensive surveys have occurred for the past several years, and are continuing for the foreseeable future. All spring and riparian areas would be surveyed prior to any treatment activities. The portions of the springs inhabited by the relict leopard frog would not be treated by prescribed burning. Instead, under the direction of the wildlife biologist, non-native vegetation would be cut and removed from these areas. No slurry or fire retardent chemicals would be utilized in spring and riparian areas or within 300-feet of these areas.

Riparian Areas

Suppression actions would be undertaken in riparian areas, except those designated as tamarisk control areas, to prevent riparian areas from burning in order to preserve streamside vegetation and upslope cover and prevent further erosion. No slurry or fire retardent chemicals would be utilized in spring and riparian areas or within 300-feet of these areas.

All herbicides utilized in riparian areas would be applied according to label and not applied directly to water. Backpack sprayers would be utilized which pinpoint the herbicide treatment to the cut stumps and/or the small tamarisk resprouts.

Wilderness Areas.
Suppression and burn methods used would be those that would minimize the impact of the action and the fire itself to ensure that the wilderness character is preserved. The minimum tool decision tree would be utilized for each project to determine the appropriate suppression and monitoring technique.

The "Light Hand" and "Minimum Impact Suppression Techniques" (MIST) (Appendix E) would be employed for all fire activities where determined appropriate after a minimum tool evaluation. Light hand suppression involves the use of minimum impact strategies and tactics. Each burn would be evaluated on a case-by-case basis to determine the appropriate tools. The appropriate tool would depend on the acreage of the area, the location of the unit, the resource goal for that unit, the timing of the treatment, and the staff available for the treatment and/or suppression activities.

Prescribed burn units are located and designed to make use of natural and unnatural fuel breaks. Lake Mead NRA burn unit boundaries utilize roads, natural fuel breaks, and natural features such as canyon rims, rocks and drainages. This avoids the use of constructed fire-lines; and most burns do not require any perimeter fireline construction. Light hand tactics in prescribed burns also exclude the use of bulldozers. Handlines are the only constructed fireline used at Shivwits. Indirect fire suppression strategy using natural barriers and backfiring and burnout creates less impact and line construction than direct attack.

Other light hand suppression actions include air attack using retardant lines, engines and helicopters using "wetlines" and "coldtrailing" the fire perimeter instead of line construction.

Fire lines and other soil scars would be restored after the completion of management activities. Park managers would apply the minimum requirement concept to determine the appropriate management practice and the minimum tool analysis to determine the appropriate equipment used in proposed and potential wilderness areas in order to preserve the wilderness character of the area.

Grazing
Grazing may be temporarily restricted in some treatment areas. However, after a period of 1 to 2 years, grazing could be reinstated in certain treatment areas if park biologists and BLM Range Conservationists determine that these areas are suitable for grazing.

Air Quality
Smoke management is critical within this region when managing any form of fire. Arizona Department of Environmental Quality (ADEQ) and Clark County Department of Air Quality smoke management procedures, requirements, and recommendations would be followed during all phases of a prescribed fire, during any suppression activity, or during burning of treated vegetation debris.

A burn plan would be submitted to the appropriate agency for approval upon designation of a prescribed fire, followed by a daily burn request and accomplishment report (Arizona only). Monitoring of smoke would be a high priority that would include approximate volume, dispersal, mixing heights, atmospheric conditions, and any other smoke concerns.

Scenic Quality
Under the action alternatives, management objectives would include requirements that the existing character of the natural landscape be retained. Any changes caused by the treatment of vegetation would repeat the basic elements (line, form, color and texture) found in the predominate natural features of the landscape.

Cultural Resources
Impacts to cultural resources resulting from fire management actions can be direct (heat from fire impacts a cultural resource), operational (fire management operations such as line construction and staging impacts a cultural resource), or indirect (direct and/or operational impacts alter a cultural resource or the context in which it is found to the point where that resource is further impacted). Direct, operational and indirect effects are discussed in Appendix H.

Specific mitigation and monitoring measures employed for cultural resources at Lake Mead NRA are discussed in Appendix H. The information presented below is summarized from that document.

Direct Effects: Direct effects to cultural resources can result during wildfires, wildland fire for resource benefits (WFRBs), and prescribed burns. Very generally, the more intense the fire behavior, the greater the chance of direct effects. However, some materials, such as wood, are very vulnerable to even low intensity fires. Direct effects can range from complete consumption of a resource (e.g., a wooden structure) to the loss or distortion of resource attributes (e.g., glass bottle melts, obsidian hydration rind eliminated).

Mitigating and monitoring the direct impacts of fire on cultural resources will be accomplished through a variety of methods.

- A pre-burn cultural resources survey of the appropriate extent and intensity will be conducted in every prescribed burn unit. This survey will encompass not only the unit itself, but also take into account surrounding areas that do, or have the potential to, contain cultural resources of interest. In areas where pre-burn ground visibility precludes adequate survey, such areas will be noted and inspected in a post-burn phase for any undocumented resources.
- Pre-burn survey may be conducted in FMU-3 during Wildland Fires for Resource Benefit (WFRBs) if cultural resources of interest are known or expected to occur in the maximum management area (MMA). If the fire intensity of a WFRB is expected to exceed the damage threshold of cultural resources of interest, a Cultural Resource Specialist will work with Fire Management staff to configure the MMA so that resource damage resulting from direct effects will be minimized. In cases where damage levels will unacceptable, a proposed WFRB will be declared wildfire and suppressed using the appropriate measures.

- All documented cultural resources of interest will be assessed with respect to vulnerability from direct fire effects, including material composition and condition and predicted fire intensity.
- In cases where a cultural resource of interest is likely to sustain adverse impacts from direct fire impacts, appropriate mitigation measures will be employed. These include, but are not limited to, reducing excess fuel loads, constructing fuel breaks, use of fire retardants and shelters, permanent or temporary resource collection and field documentation. Particularly significant and/or vulnerable cultural resources of interest outside of prescribed burn areas will be mitigated and maintained on an appropriate cyclical basis.
- A monitoring program will be initiated in order to assess the effectiveness of particular mitigation measures. This will include observations on treated resources of interest during fires, as well as post-burn assessments of treated resources. Objective measurement criteria will be utilized, and the results employed to refine mitigation measures.

Operational Effects: Operational effects are most likely to occur during wildfires, prescribed burns, and mechanical thinning projects. Wildfire suppression is usually less systematic and can involve the use of mechanized equipment for the construction of firelines, safety zones, and helispots. Mop-up and rehabilitation can also be expected following wildfires. Operational effects associated with prescribed burns and mechanical thinning can generally be accounted for prior to implementation.

Mitigating and monitoring operational effects on cultural resources will be accomplished through a variety of methods.

- All areas of proposed ground disturbance and fire management activity will be inspected for cultural resources of interest prior to all prescribed burns and mechanical thinning projects.
- To the extent possible, all potentially ground disturbing activities associated with prescribed burns and mechanical thinning projects will be conducted outside the boundaries of cultural resources of interest. In cases where this is not possible and/or desirable, those operational activities resulting in the least impact will be employed. Cultural resources of interest will also be considered when implementing firing operations during prescribed burns.
- A fireline-qualified Cultural Resource Specialist will be present during and after all prescribed burn and mechanical thinning projects in order to conduct additional survey as needed, as well as monitor activity around cultural resources of interest.
- In the event of a wildfire in or adjacent to Lake Mead NRA, pertinent cultural resources data will be made available to appropriate Fire Management personnel for planning purposes. A Cultural Resource Specialist will be available on all incidents to provide input on cultural resource issues to the appropriate Fire Management personnel. To prevent unwanted distribution, access to cultural resources data will be closely controlled.
- In the event of a wildfire in or adjacent to Lake Mead NRA, a Resource Advisor with knowledge of cultural resources will accompany fire crews into the field. Ideally, a Resource Advisor will be assigned to each hand crew or piece of heavy equipment, with a minimum adequate staffing level of one Resource Advisor per division. Resource Advisors will survey areas of proposed ground disturbance, note cultural resources already impacted by direct or operational effects, and identify potential areas for indirect effects.

- Prior to each fire season, a Cultural Resource Specialist will give a presentation on cultural resources during Annual Fireline Safety Refresher Training courses held at Lake Mead NRA. A brief information guide on cultural resources and Minimum Impact Suppression Tactics (MIST) will be prepared and made available to pertinent fire management entities that have suppression responsibilities within and adjacent to Lake Mead NRA. Following winters with precipitation in excess of eight inches at the Lake Mead NRA headquarters in Boulder City, a Cultural Resource Specialist will visit fire stations of cooperator fire management entities and provide information cultural resources and MIST.

Indirect Effects: Indirect effects can potentially occur following wildfires, WFRBs, prescribed burns and mechanical thinning projects. Some types of indirect effects, such as erosion and increased tree mortality are more likely to result from high intensity fires. Indirect effects can manifest immediately following a fire management action, or may take years to materialize.

Mitigating and monitoring indirect effects on cultural resources will be accomplished through a variety of methods.

- A Cultural Resource Specialist will inspect all recorded cultural resources of interest following a given fire management action. Information on potential indirect effects will be collected for each, and, if necessary, appropriate mitigation tactics implemented such as site stabilization measures in the case of erosion threats, felling of fire-killed snags on or near cultural resources, and stepped up law enforcement patrols to deter looting.
- A Cultural Resource Specialist will perform select cultural resource inventory of areas subjected to fire management actions. The amount and location of inventory will be dictated by a combination of cultural resource and fire-related factors. For example, previously unsurveyed areas with high cultural resource sensitivity that burned at a high intensity would be preferentially surveyed over a high sensitivity area that burned at a low intensity. Areas with poor ground visibility, such as the ponderosa pine stands in FMU-3, will be targeted for post-burn survey following prescribed burns, WFRBs and wildfires. All previously undocumented cultural resources will be recorded to current professional standards, and data collected on resource condition and potential indirect effects. If necessary, appropriate protective measures will be implemented on resources of interest.

Standard Procedures: In addition to the procedures identified to mitigate and monitor direct, operational and indirect fire effects, the following measures will be taken in association with each Fire Management action at Lake Mead NRA and Parashant NM.

- Native American consultation includes:

Consult with tribes in initial phases of planning of burns and treatment activities. Consultation has been ongoing and will continue as new areas are considered for burning and new issues develop.

Work with tribes to identify sensitive areas in terms that are agreeable to tribal members (e.g., document location, but not cultural function). Develop acceptable protocol for making that information available to fire personnel for both prescribed burns and wildfires.

Following wildfires, provide tribes notification via a narrative/report, letter of explanation with map, and/or news release relating to the fire.

- Wildfires in Traditional Cultural Properties:

Contact affiliated tribes immediately. Keep tribes informed through the fire event. Provide summary letter of fire and suppression activities.

Use water drops over retardant where appropriate. If retardent is crucial to suppression of fire, clear retardent is requested. Colored retardant would be avoided in sacred areas.

Use fire trained archeologists to work with crews to avoid destroying archeologically dense areas.

Utilize light on the land suppression techniques.

Restore area utilizing native grasses and other native vegetation.

- Lake Mead NRA Fire Management staff will provide pertinent project information to Cultural Resource Specialists prior to each proposed undertaking, such as project schedule and description, maps (project boundary, areas of proposed disturbances, fire history, fuels, etc.) and burn prescriptions. Ideally, such information will be available at least one year prior to project implementation.
- All Cultural Resource Specialists performing duties for fire management activities with Lake Mead NRA will meet minimum qualifications put forth in the *Secretary of Interior's Guidelines for Historic Preservation Projects, Professional Qualifications Standards* (1983).
- All cultural resources will be documented using respective record forms of the states of Nevada or Arizona.
- Reporting standards will follow those outlined in the cultural resource component of the Fire Management Plan.
- Opportunities for fire-related research will be identified and funding sought from the appropriate sources. Potential research topics at Lake Mead NRA and Parashant NM include direct and indirect effects on material culture, fire effects on plants of importance to Native Americans and reconstructing aboriginal burning patterns. Potential funding sources include FirePro Research, various cultural resource sources (e.g., Systemwide Archeological Inventory Program) and external programs.

Visitor Use
Under all action alternatives, visitors would be directed to alternate recreation sites and informed that fire suppression activities, prescribed fire activities, or vegetation treatments were taking place.

Safety
Fire crews would wear required personal protective equipment (PPE) at all times during any prescribed fire, fire suppression, or debris burning activities. Mandatory PPE includes:

- 8-inch high, laced, leather boots with lug soles
- Fire shelter
- Hart hat with chin strap
- Goggles/safety glasses
- Ear plugs
- Nomex shirts
- Nomex trousers
- Leather gloves

No PPE would be purchased that is not National Fire Protection Association compliant or that does not meet standards.

Each burn plan would contain holding and wildland fire transition plans describing appropriate actions in the event the prescription is exceeded. All burn plans would address the need for alerting park neighbors and appropriate public officials to the objectives and timing of the planned burn and designate a specific individual as responsible for making these notifications. No fires would be ignited unless the responsible personnel determined immediately prior to the fire that optimum conditions to prevent the fire from exceeding prescription existed.

Fire suppression zones would be designated around administrative structures, residential areas, and recreational sites. In these areas, appropriate suppression activities would occur to protect these resources.

Under all alternatives, hazard fuel reduction would occur around residential, historic, and administrative structures to prevent wildland or structural fires in these areas.

Recreation Area and National Monument Operations
Fire management units would be established. Prescriptions would be set within these units to determine the appropriate management action. The purpose of these prescriptions and the decision and criteria process is to prevent fires from developing into high-intensity wildfires and to allow managers to meet resource objectives.

The policies for handling an escaped prescribed fire are contained within RM-18 and existing interagency agreements and would be followed under this plan.

Fire effects monitoring would be completed in selected plots after each burn to evaluate the degree to which objectives are accomplished. Long-term monitoring of the overall project would be required to document that overall programmatic objectives are being met and undesired effects are not occurring.

Alternatives Considered but Eliminated from Further Evaluation
Several options for designating fire management units were considered in the formulation of the fire management plan. Managers determined that designating that the three alternatives provided the full spectrum of reasonable alternatives based on the guidelines established in RM-18.

Wildland fire use was not considered feasible in the Mojave Desert region of the recreation area. Fires in the Mojave Desert historically have been infrequent and small. The primary cause of wildfires in this region today is the spread of nonnative grasses. Managers and scientists have determined that full suppression in the desert is necessary to preserve the native vegetative communities and prevent the spread of nonnative grasses (USGS 2001).

Wheeled/tracked equipment use was considered for the Shivwits area. However, this alternative was eliminated based on NPS *Wilderness Management Policies, DO-41*, which specifically requires the use of the least intrusive tool, equipment, device, force, regulation or practice determined necessary to accomplish an essential task in wilderness or potential wilderness areas. Use of wheeled or tracked equipment to accomplish vegetation removal for the entire Shivwits area is not practical, however mechanical treatment will be used in some areas to achieve the desired vegetative mosaic. There are some areas that have been chosen for mechanical treatment and these areas are specifically identified in the vegetative treatment and hazard fuel reduction plan (Appendix A).

Bio-control was considered on the Shivwits Plateau, but determined to be infeasible. It is also against NPS Policy to implement bio-control of native species. In addition, the vegetation within the management area includes ponderosa pine, juniper forests and sagebrush. Biological control has not been developed for these species because they are desirable native species and the concern is plant density and plant diversity. Meeting the objectives for managing plant density and diversity can be accomplished in priority areas using other management strategies such as wildland fire use, prescribed burning, and mechanical treatment. Biological control provides little control over where it is applied, and it may not be compatible with surrounding landowners.

Permit Requirements
This project does not require compliance with Executive Order 11988 (Floodplain Management), since there would be no construction within the flood plain. It does require compliance with Executive Order 11900 (Protection of Wetlands), since components of the project involves restoration activities and removal of non-native species in riparian and spring areas within the recreation area. Actions designed specifically for the purposes of restoring degraded natural wetland, stream, riparian, or other aquatic habitats or ecological processes are excepted from NPS Statement of Finding Requirements (NPS *Procedural Manual #77-1, Wetland Protection*, Section 4.2 A.1.e.).

The fire management plan requires formal consultation under section 7 of the Endangered Species Act of 1973, as amended. A biological assessment has been prepared for the U.S. Fish and Wildlife Service and formal consultation has been initiated.

Upon designation of each prescribed fire, a separate burn plan would be submitted to the Arizona Department of Environmental Quality and/or the Clark County Department of Air Quality

Management for approval, followed by a daily burn request and accomplishment report. In addition, an approved burn plan for each prescribed fire would be filed in the Lake Mead NRA superintendent's office prior to each burn.

Environmentally Preferred Alternative

The environmentally preferred alternative is the alternative that will promote NEPA, as expressed in section 101 of NEPA. This alternative will satisfy the following requirements:

- Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
- Assure for all generations safe, healthful, productive, and esthetically and culturally pleasing surroundings;
- Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable or unintended consequences;
- Preserve important historic, cultural, and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice;
- Achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities; and,
- Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Alternative C is the environmentally preferred alternative because, overall, it would best meet the requirements of Section 101 of NEPA. It would provide protection to the Lake Mead NRA environment, including protecting the Mojave Desert environment from the spread of non-native vegetation. It would help enhance the quality of the vegetative communities on the Shivwits Plateau, by restoring the natural processes, while utilizing control measures to preserve important historic, cultural, and natural aspects of our national heritage. Overall, it would ensure a safe, healthful, productive, and esthetically and culturally pleasing surrounding.

Comparison of Impacts

Table 3 summarizes the potential long-term impacts of the proposed alternatives. Short-term impacts are not included in Table 3, but are analyzed in Section 4. Impact intensity, context, and duration are defined in Section 4.

Table 3. Comparison of Long-Term Impacts from Alternatives Considered

IMPACT TOPIC	ALTERNATIVE A (No Action)	ALTERNATIVE B	ALTERNATIVE C
Soils and Vegetation	Potentially adverse impacts	Potentially beneficial impacts	Beneficial impacts
Wildlife	Potentially adverse impacts	Beneficial impacts	Beneficial impacts
Threatened and Endangered Species	No long-term impacts	No long-term impacts	Beneficial impacts
Riparian Areas	No long-term impacts	No long-term impacts	No long-term impacts
Wilderness Areas	No long-term impacts	Beneficial impacts	Beneficial impacts
Grazing	Potentially adverse impacts	Beneficial impacts	Beneficial impacts
Air Quality	No long-term impacts	No long-term impacts	No long-term impacts
Scenic Quality	No long-term impacts	Potential for beneficial impacts	Potential for beneficial impacts
Cultural Resources	Potential for adverse impacts	Potential for adverse, long-term impacts	Potential for beneficial impacts
Visitor Use	No long-term impacts	No long-term impacts	No long-term impacts
Safety	Potential for adverse impacts	No long-term impacts	No long-term impacts
Recreation Area Operations	No long-term impacts	No long-term impacts	No long-term impacts

SECTION III: AFFECTED ENVIRONMENT

The affected environment section describes the components of the recreation area included in the fire management plan. The descriptions include the interface areas, the desert environment, and the Shivwits region of the recreation area. A descriptive summary of the proposed and proposed potential wilderness areas is also included.

Interface Area FMU

This unit has 23 separate interface areas that encompass residential areas, mobile home parks, commercial buildings, administrative sites and developed campgrounds, that are within or directly adjacent to the Lake Mead NRA boundary.

The following are descriptions of the interface areas.

1. Davis Dam:

Interface Area 1 includes Lake Mead NRA lands in Nevada and Arizona from Davis Dam south to Nevada Highway 163. Included are the vendor-leased areas of Davis Camp and Nevada Sports Park.

Topography is generally flat as the area is within the Colorado River corridor. Fuels include about 200 acres of salt cedar (*Tamarix* sp), cottonwood trees, and various reeds and riparian grasses adjacent to Davis Camp. Creosote, bursage and grasses (during wet years) are predominant in other areas. Ornamental vegetation is common around structures and campgrounds.

The entire area is accessible by road (no more than a ½-mile hike is required to access any portion). Major roads circle the entire area, so the threat of a fire burning off site is minimal.

Portions of the area are bordered by BLM or BOR lands. Fire suppression standards on these borders coincide with Lake Mead NRA suppression standards and are identified in operating plans between the agencies.

The towns of Bullhead City, Arizona and Laughlin, Nevada are directly south of the interface area. Fire suppression standards for both cities are in accordance with Lake Mead NRA suppression standards for the interface area.

2. Katherine Landing:

Interface Area 2 includes a ¼-mile buffer around the perimeter of Katherine Landing. Katherine Landing is the major launch site for the southern portion of Lake Mohave. The ¼-mile buffer

protects areas around a NPS administrative site, employee housing, campground, motel, restaurant and boat launch.

Topography is mostly flat with some gently rolling slopes. Fuels consist primarily of creosote, bursage and grasses (during wet years). Ornamental vegetation in and around the recreational trailer village and employee housing is overgrown and will need continual maintenance.

The whole area is engine accessible and a hydrant system is in place. Katherine Landing is wholly within the recreation boundary, but fire does pose some threat to private holdings at Princess Cove and Katherine Mine. The recreation area may staff a wildland engine at the site depending on fire danger and activity.

3. Princess Cove/Cabin Site Point:

Interface Area 3 includes a ¼-mile buffer around the 25 private cabins on leased government land at Princess Cove. The cabins are within the Lake Mead NRA boundaries. No fire protection district exists, so both structure fires and wildland fires are Lake Mead NRA's responsibility.

Topography consists of rolling hills with a number of small desert washes. Fuels consist of creosote, bursage, and grasses (during wet years). When grasses are prevalent, there are threats of quick moving wildland fire burning up the small washes. The cabins are located primarily on higher ground and would be in the path an oncoming fire. Ornamental vegetation is dense around a number of the cabins.

Princess Cove and Cabin Site Point is accessible by road. A structural fire engine is located at Katherine Landing and is supported by staff on an as needed basis. The closest wildland engine may be located at Katherine Landing.

4. Katherine Mine:

There are about 35 private residences with no rural fire protection located within a close proximity of the Lake Mead NRA boundary. Structure and wildland fire protection is a Lake Mead NRA responsibility within the park. NPS resources may elect to provide mutual aid or take suppression action on fires that threaten park property. The closest wildland engine may be located at Katherine Landing.

Topography is mostly flat with some rolling hills.

5. Cottonwood Cove:

Interface Area 5 is located on Lake Mohave, 9 miles east of Searchlight, Nevada. It is the main marina on Lake Mohave within Nevada. It includes an administrative site, recreational trailer village, campground and restaurant. Structure and wildland fire protection is a Lake Mead NRA responsibility.

Topography is mostly flat with some steep slopes to the west. Access to structures and other facilities is good. The threat of an interface fire is low to moderate. Ornamental vegetation around trailers and the campground needs to be maintained. Cottonwood Cove has a structure engine at the site that is supported by collateral duty personnel.. The closest wildland engine is located at Boulder City and is 1½ hours away.

6. Nelson's Landing:

Interface Area 6 is on Nevada Highway 165 and south of Boulder City. Nelson's Landing is the center of the historic mining district of Eldorado Canyon. There are about 75 permanent residents and about 150 structures nearby in the town of Nelson. The structures range from new houses and mobile homes to historic mining buildings. The town is about 2 miles west of the Lake Mead NRA boundary.

Topography is steep to rolling with limited access. During wet years, when significant grasses exist a fire could easily travel from Lake Mead NRA lands into the outer edges of the community. As with many old mining towns the location and type of structures is varied. Access/egress is adequate roads in most areas. Structure and wildland fire response is a minimum of 1 hour.

7. Willow Beach:

Interface Area 7 is located 14 miles south of Hoover Dam off U.S. Highway 93. There is an U.S. Fish and Wildlife Service fish hatchery, and a small marina at the site. The threat from a wildland fire is low to moderate due to a lack of heavy fuels and good access. Structure and wildland fire response is 45 minutes.

8. Boulder City

Interface Area 8 is surrounded by Lake Mead NRA lands on the south, west and east sides. Boulder City is a town of about 14,000 people and serves as the headquarters site for Lake Mead NRA. The city is primarily a residential area and a tourist town that services visitors to Lake Mead and Hoover Dam.

Topography is primarily flat with rolling hills to the north. The threat of a serious interface fire is moderate during wet years, when light fuels will carry fire. Fire equipment access and escape routes pose no problems. Structure and wildland fire response is approximately 10 minutes

9. Boulder Beach and Marina

Interface Area 9 is located 4 miles northwest of Boulder City with a buffer zone of 1 mile. Facilities include an administrative site, recreational trailer and RV Park, campground, marina, employee housing and tour boat landing.

Topography is generally flat to rolling. Ornamental vegetation is heavy around developed areas and needs continual maintenance. The threat of a large interface fire is moderate to high depending on yearly moisture. Fire equipment access and escape routes pose no problem. The trailer village includes many tightly spaced older homes which could pose a difficult control problem during a wind event. Structure and wildland fire response is 10 minutes.

10. Las Vegas Bay

Interface Area 10 is located at the end of Lake Mead NRA road 86, 2 miles east of Lake Las Vegas. Facilities include an administrative site and campground. .

Topography is flat. Ornamental vegetation needs to be maintained around structures. Fire equipment access/egress is not a problem. The threat of an interface fire is low to moderate depending on yearly moisture. Structure response is 10 minutes and wildfire response is 20 minutes.

11. Lake Las Vegas.

Interface Area 11 is a multi-billion dollar resort and housing development located within a ½-mile of the Lake Mead NRA boundary. Fire protection is provided by the Henderson Fire Department for both structure and wildfire. The probability of an interface wildfire burning off recreation area lands into the sub-division is low to moderate. Significant winter and spring rains would be needed to create the fine fuels to carry a fire.

Topography is rolling hills with good access/egress throughout. Structure response is 5 minutes and wildfire response 20 minutes.

12. Callville Bay.

Interface Area 12 is located off Northshore Road on the Callville Bay access road. Facilities include a ranger station, marina with restaurant and store, recreational trailer village and campground.

Topography is generally flat. Ornamental vegetation needs to be maintained around structures. Access/egress is not a problem. The threat of an interface fire is low to moderate depending on yearly moisture. Response to a wildfire is 40 minutes away

13. Stewarts Point

Interface Area 13 is located off Northshore Road on park approved road 103. The site is on NPS administered land and contains 60 houses/cabins that are on long term leases from Lake Mead NRA. There is a small undeveloped campground in a stand of tamarisk.

Topography is flat to rolling. Tamarisk grows in close proximity of a number of houses. The threat of an interface fire is moderate to high. Road access is adequate. Structure protection is 30 minutes and wildfire protection 45 minutes away.

14. Echo Bay.

Interface Area 14 is located off Northshore Road on the Echo Bay access road. Echo Bay has an administrative site, recreational trailer village, campground, hotel and marina.

Topography is generally flat to rolling and bordered by Echo Wash and Calico Wash. Ornamental vegetation will need continual maintenance. Access and egress is good. The threat of an interface wildfire is low to medium, with little chance for spread outside of the immediate area.

15. Overton, Nevada.

Interface Area 15 is located just north of where Lake Mead and the Muddy River meet. This is the highest priority Wildland Urban Interface area near the park. Overton is a small town of about 2,500 people that is rapidly expanding. The Lake Mead NRA boundary abuts Overton to the south.

Topography is mostly flat and rolling. The predominant wind would push a fire off Lake Mead NRA and into Overton. There is a serious threat to structures from a wildland fire burning off Lake Mead NRA administered lands. Fuels include heavy stands of tamarisk and other flammable fuels. Access to threatened areas is poor to adequate, depending on the proximity to the center of town. Structure fire response is15 minutes away in Logandale and wildland fire response is 30 minutes from the BLM Logandale station.

16. Hoover Dam

Interface Area 16 is the area immediately surrounding Hoover Dam and the U.S. Highway 93 corridor within 3 miles of the dam. The area includes the Hacienda Hotel and Casino, gas station, and the Hoover Dam complex.

Topography is rocky with steep slopes that are inaccessible to vehicles. Vehicle traffic is heavy and gridlock is common on U.S. Highway 93 going over the dam. Though the fuels are generally light and scattered, fine fuels do accumulate during wet years to provide a carrying mechanism for fire. If a wildfire were to occur in this area, visitor protection and traffic flow would be a major safety concern. Initial attack on a weekend would require immediate air support, due to a slowed response for equipment.

17. Temple Bar.

Interface Area 17 is at the end of Temple Bar road, 25 miles due east of U.S. Highway 93. Facilities include an administrative site, recreational trailer village, employee housing, restaurant, store and marina.

Topography is flat to rolling with light fuels. Ornamental vegetation around structures needs continual maintenance. The threat of an interface wildfire is low to medium. Access is good and fire vehicles can maneuver among the structures. Initial wildfire response would be by helicopter, followed by equipment.

18. Meadview

Interface Area 18 is located on the Pearce Ferry road, 44 miles east of U.S. Highway 93. Meadview is a town of 1,600 permanent and 2,000 seasonal residents. More than one thousand homes and businesses are scattered throughout an 8 square mile area. Sixty percent of the community lies within the Lake Mead NRA boundary. Wildfire protection responsibility is divided between Lake Mead NRA and BLM.

Topography is flat to rolling. Fuels consist of Joshua trees, yucca, and desert shrubs. When winter and spring precipitation is heavy, fine fuels are plentiful. Fine fuel buildups create a serious fire problem for the community and surrounding area.

Meadview has a small volunteer fire department, with no wildfire capability. The closest federal wildfire engine is a minimum of 90 minutes away. Helitack is a minimum of 30 minutes away in Kingman, Arizona. An interagency operating plan has been developed to clarify responsibilities and dispatch procedures. Plans include the positioning of a severity engine in Meadview when extreme fire conditions exist.

19. Tassi Ranch (Canyon District)

Interface Area 19 consists of a ranch house, outbuildings, corrals, irrigated pastures, and an irrigation canal system. Cultural resources have been observed on site. The ranch is managed as a cultural landscape.

Topography is flat with moderate slopes on each side of the ranch. Fine fuel buildups during wet years can create a serious fire threat. Initial attack should be with air resources. Ground resources are a minimum of 3 ½ hours away

20. Jumbo Mine Area (Canyon District)

Interface Area 20 consists of a number of old mines that include the Jumbo, Lakeshore and Union mines.

Topography is rolling to steep in an area of 3 square miles. Buildups of annual fine fuels during wet years creates a serious fire threat. Initial attack would be with air resources. Ground crews are a minimum of 3 hours away.

21. Blue Point Spring (North Shore District)

Interface Area 21 is located on Northshore Road between approved roads 103 and 108. The spring is a place for roadside travelers to picnic and relax.

The total spring area is less than 2 acres and consists of moderate to heavy brush. The spring has been used for centuries and cultural concerns are high. Wildfire response is a minimum of 45 minutes away.

22. Rogers Spring (North Shore District)

Interface Area 22 is located on Northshore Road, 2 miles south of Blue Point Spring. The spring has a swimming and picnic area. The total area is less than 3 acres and consists of heavy brush and palm trees with a ¼-acre pond. Cultural concerns are a high priority. Wildfire response is a minimum of 45 minutes away.

23. Lake Mohave View Ranchos (Canyon District)

Interface Area 23 is adjacent to the Lake Mead NRA boundary. There are 40 homes within the project. Seventy-five percent of these are manufactured homes and the rest are built on site cinder block homes. Structure and wildland fire protection is provided by the recreation area.

Topography is flat to rolling with one way access. Narrow dirt roads wander in an around the structures. There is a serious wildfire threat during wet years when grasses are abundant. There is a structure engine located at Katherine Landing manned on an as needed basis. Wildland engines are a minimum of an hour away.

The Desert Environment

A. The Desert Zone

The desert habitat zone is mainly on the flats and slopes throughout the park up to 6000 feet. The dominant community in this area is the creosote bursage community. Grasses rarely occur in this community, but where they do occur they are responsible for carrying the fire. The threatened desert tortoise (*Gopherus agassizii*) occurs throughout this zone, and critical habitat for the tortoise has been designated within the recreation area. There are other sensitive fauna and flora

that can be found in this zone such as the banded Gila monster (*Heloderma suspectum*) and the California bearpoppy (*Arctomecon californica*). There are also several special plant communities found within this area such as the stem-succulent scrub community found near Cottonwood Cove. In this zone is the Newberry Mountain area, which has a pinyon-juniper/oak/shrub community.

B. Tamarisk Zone

The tamarisk zone is found in the canyon bottomlands, riparian washes, arroyos, and springs throughout the park except on the Shivwits Plateau (Figures 12, 13, 14, and 15). This plant quickly takes over riparian areas displacing the native flora and fauna, changes the water table, and through its decomposing foliage creates a salt layer on the soil. The endangered Southwestern willow flycatcher (*Empidonax traillii extimus*) and the relict leopard frog (*Rana onca*) can occupy riparian corridors within this zone.

Figure 12. Springs and Tamarisk Control Zones

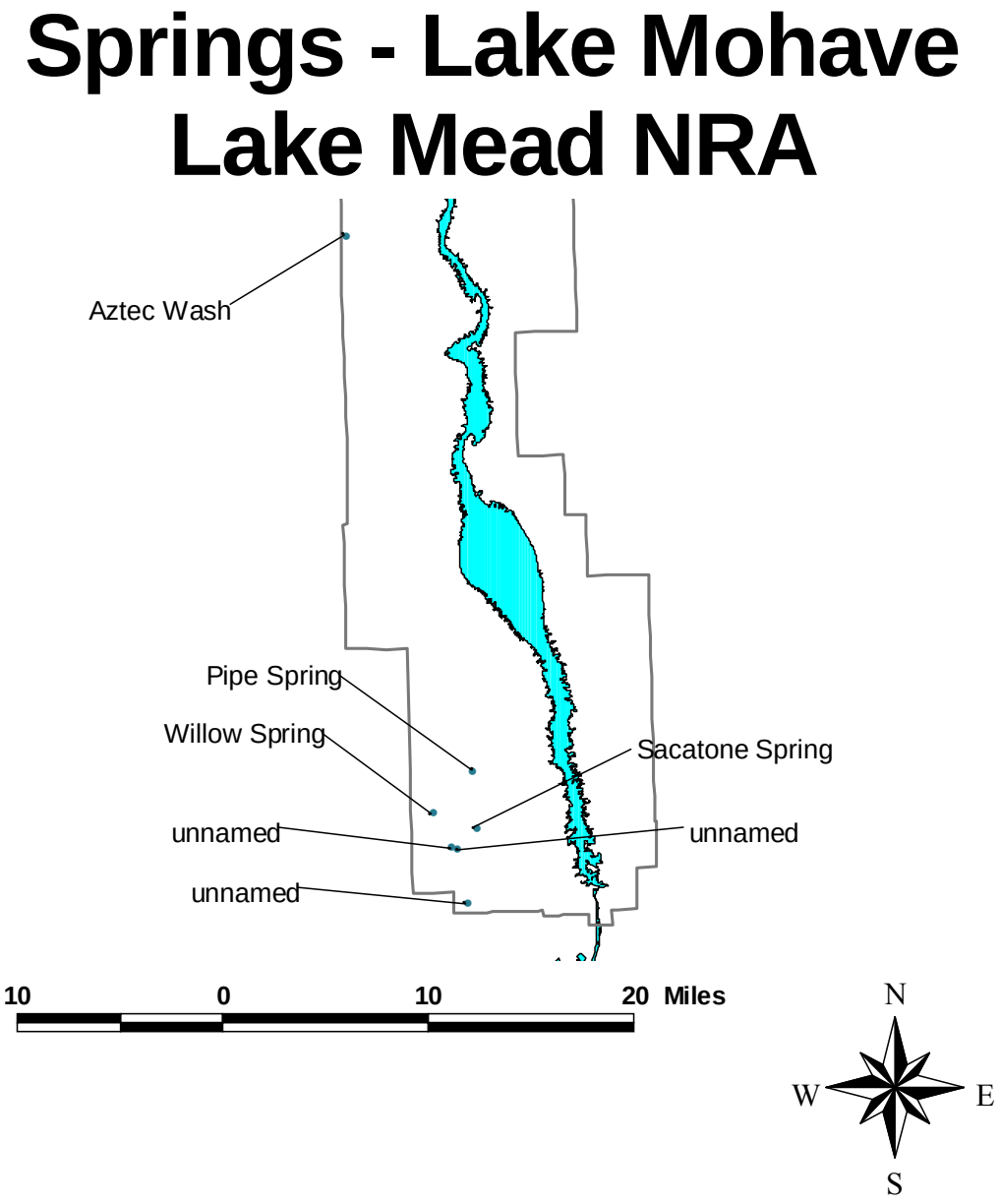


Figure 13. Springs and Tamarisk Control Zones

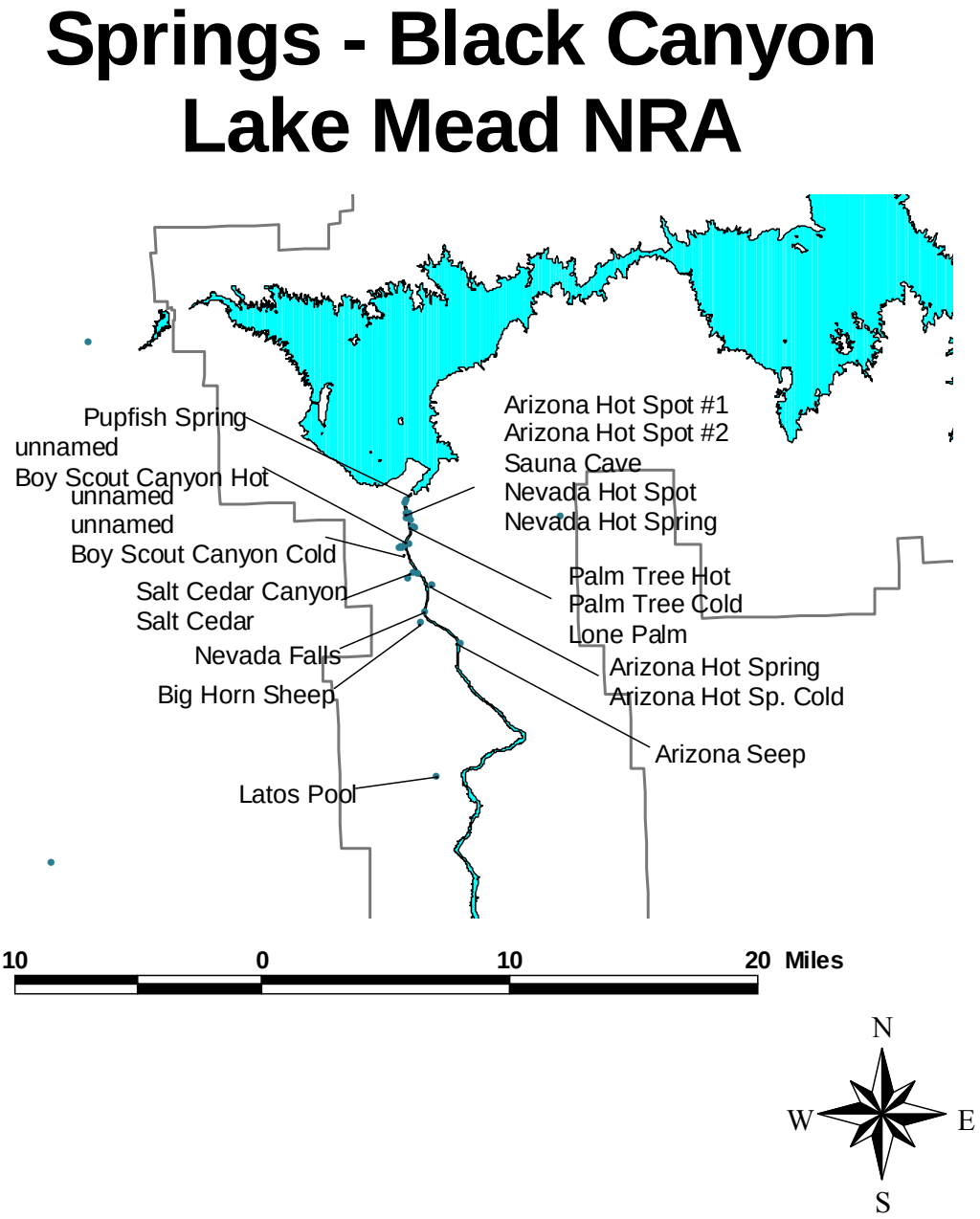


Figure 14. Springs and Tamarisk Control Zones

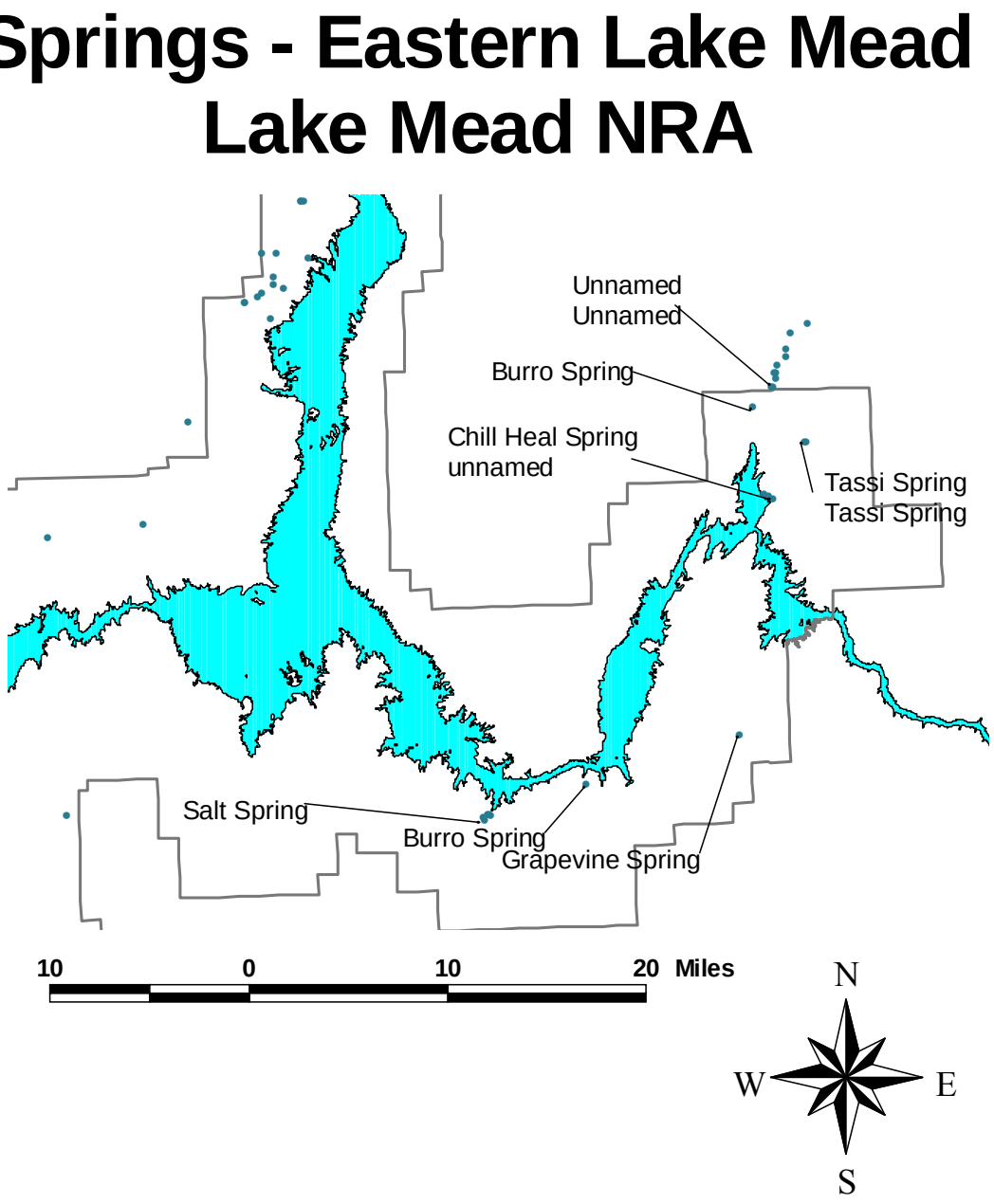
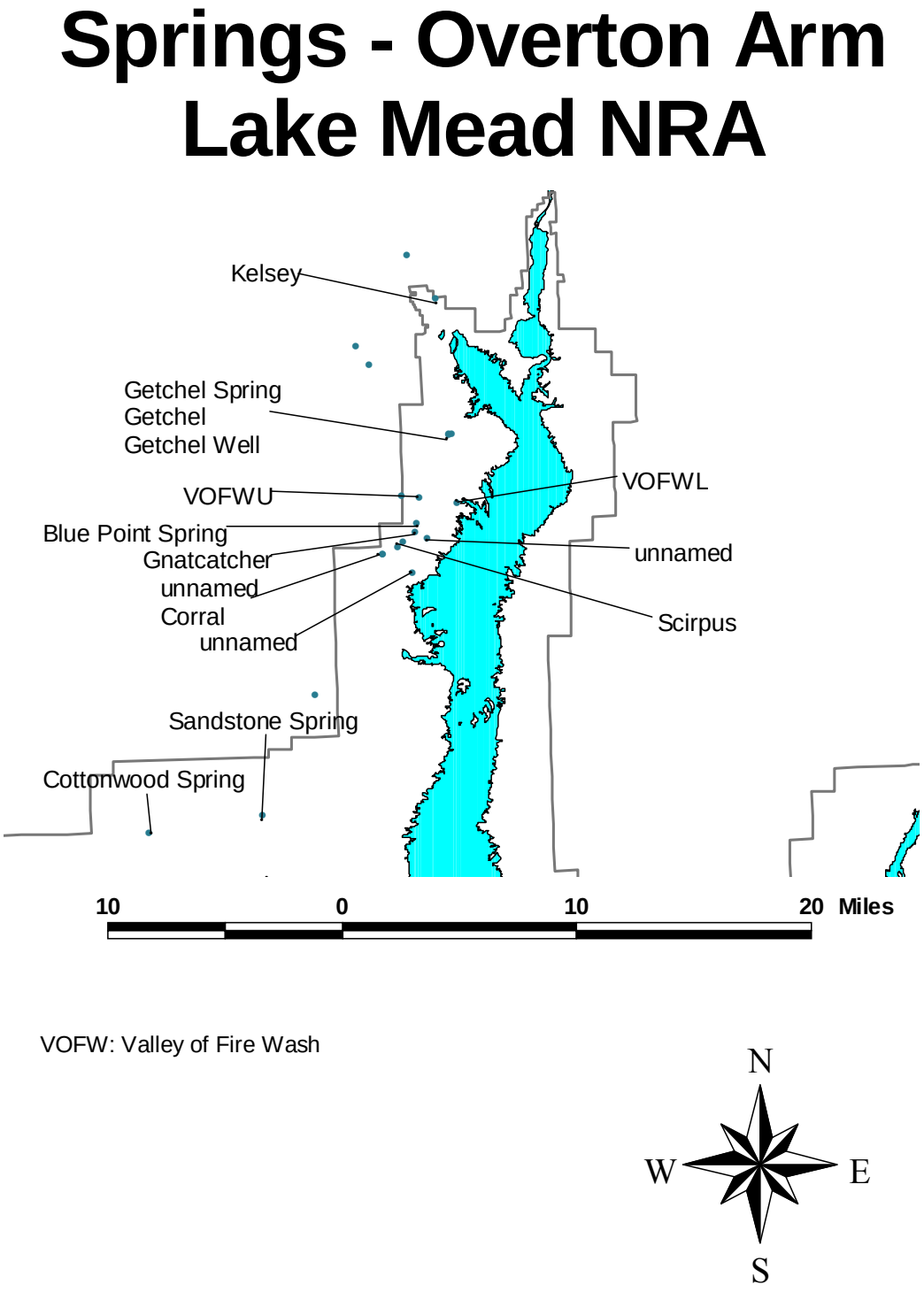


Figure 15. Springs and Tamarisk Control Zones



The Shivwits Plateau

This FMU is an extremely remote area within the Arizona Strip located on the northwest rim of the Grand Canyon. The nearest community is St. George, Utah which lies 90 miles to the north. Most of the area is without roads; access to the area is via unpaved dirt roads with varying road conditions. Most of the northern boundary is adjacent to BLM administered lands and the southern and eastern boundaries are adjacent to Grand Canyon NP. The area is managed jointly by the NPS and BLM as the Grand Canyon-Parashant National Monument.

There are three main habitat types on the Shivwits Plateau including pinyon-juniper, ponderosa pine, and sagebrush. There are several administrative sites, historical sites, and two special plant populations that would receive full suppression protection. This is also an area with numerous historic and cultural resources. Any prescribed fire or fire for resource benefit would receive an evaluation from a resource advisor.

This area includes approximately 168,000 acres of sagebrush (*Artemisia tridentata*), pinyon (*Pinus monophylla*) - juniper (*Juniperus osteosperma*) woodlands, and ponderosa pine *(Pinus ponderosa*) communities. Elevations average around 6,000 feet, and the area averages 14 to 18 inches of rainfall per year.

These areas provide habitat for a variety of wildlife species, including mule deer (*Odocoileus hemionus*), Merriam's turkey (*Melagris gallopavo merriami*) which was transplanted successfully in the area by the Arizona Game and Fish Department, and other small mammals, carnivores, raptors, and other game and non-game species.

Several special status species are known to occur, or could possibly occur in the Shivwits region of the recreation area. Federally threatened bald eagles (*Haliaeetus leucocephalus*) occur rarely on the Arizona Strip during the winter, using the area as a stop over while in migration. There is potential Mexican spotted owl (*Strix occidentalis lucida*) habitat within the Shivwits Region, though no spotted owls have been recorded. The threatened Mexican spotted owl inhabits steep, narrow, and hanging canyons with mature, uneven-aged stands of mixed-conifer and pine-oak forests. There is potential habitat for the California condor (*Gymnogyps californianus*) in the area and it has been observed in Grand Canyon NP, though no observations or nesting sites have been recorded within the recreation area. California condors have been introduced to the Arizona

Strip and are considered an "experimental nonessential" population by the U.S. Fish and Wildlife Service. Potential habitat is present for these species on the Shivwits Plateau.

Northern goshawk (*Accipiter gentilis*) nests have been recorded in coniferous forests on BLM administered lands on Arizona Strip, will winter in lower elevations, and are likely to be found within the recreation area. Peregrine falcons (*Falco peregrinus*) have been found on the Arizona Strip and may inhabit the Shivwits area year-round, utilizing the steep cliffs adjacent to Lake Mead NRA.

The rare Grand Canyon rose (*Rosa stellata*) is known to occur near Twin Points on the Shivwits Plateau. It grows in thin sandy-gravely soils with limestone pebbles overlying Kaibab limestone bedrock in open Great Basin woodland vegetation. *Penstemon distans* is a sensitive plant species that occurs on the northeastern edge of the recreation area. The fire ecology of these species is unknown. In general, *Rosa* sp. resprout after low or moderate fire events, but not enough is known about either of these species to assess fire effects.

Less than two percent of the Shivwits area has been systematically surveyed for cultural resources. The Shivwits Plateau has been inhabited since prehistoric times. It is for this reason numerous archeological resources exists here. Historic ranching activities on the plateau combine to create an excellent example of a vernacular cultural landscape. The landscape includes Horse Valley Ranch (Waring Ranch), listed on the National Register of Historic Places, along with various barns, mills, corrals, fences, tanks and roads all of which are included on Lake Mead NRA's List of Classified Structures.

Wilderness Areas within Lake Mead NRA

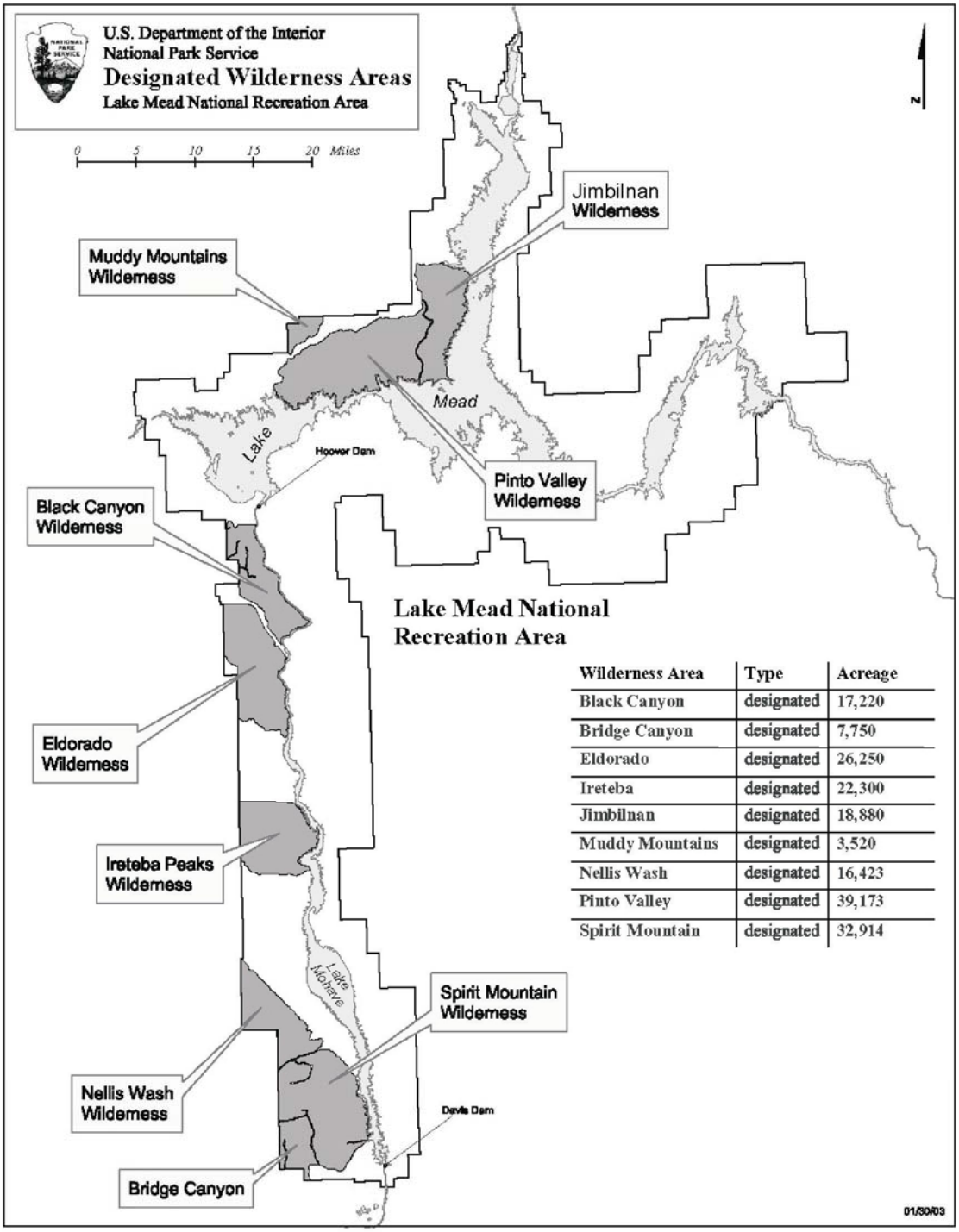
The following are areas within Lake Mead NRA that have been designated as wilderness under the Clark County Conservation of Public Land and Natural Resources Act of 2002, or that meet the criteria for wilderness or potential wilderness designation as included in the Lake Mead NRA Wilderness Proposal (1979) (Figures 16, 17, 18, 19).

The existing and proposed wilderness boundary lines of the units follow topographic features, access roads, the recreation area boundary line, section lines, and a line marking a 300-foot horizontal setback form the high-water lines of Lake Mohave and Lake Mead. Acreages are general estimates and have not been validated. Areas are listed as "designated," "proposed," or "proposed potential."

Bridge Canyon Wilderness (Designated)

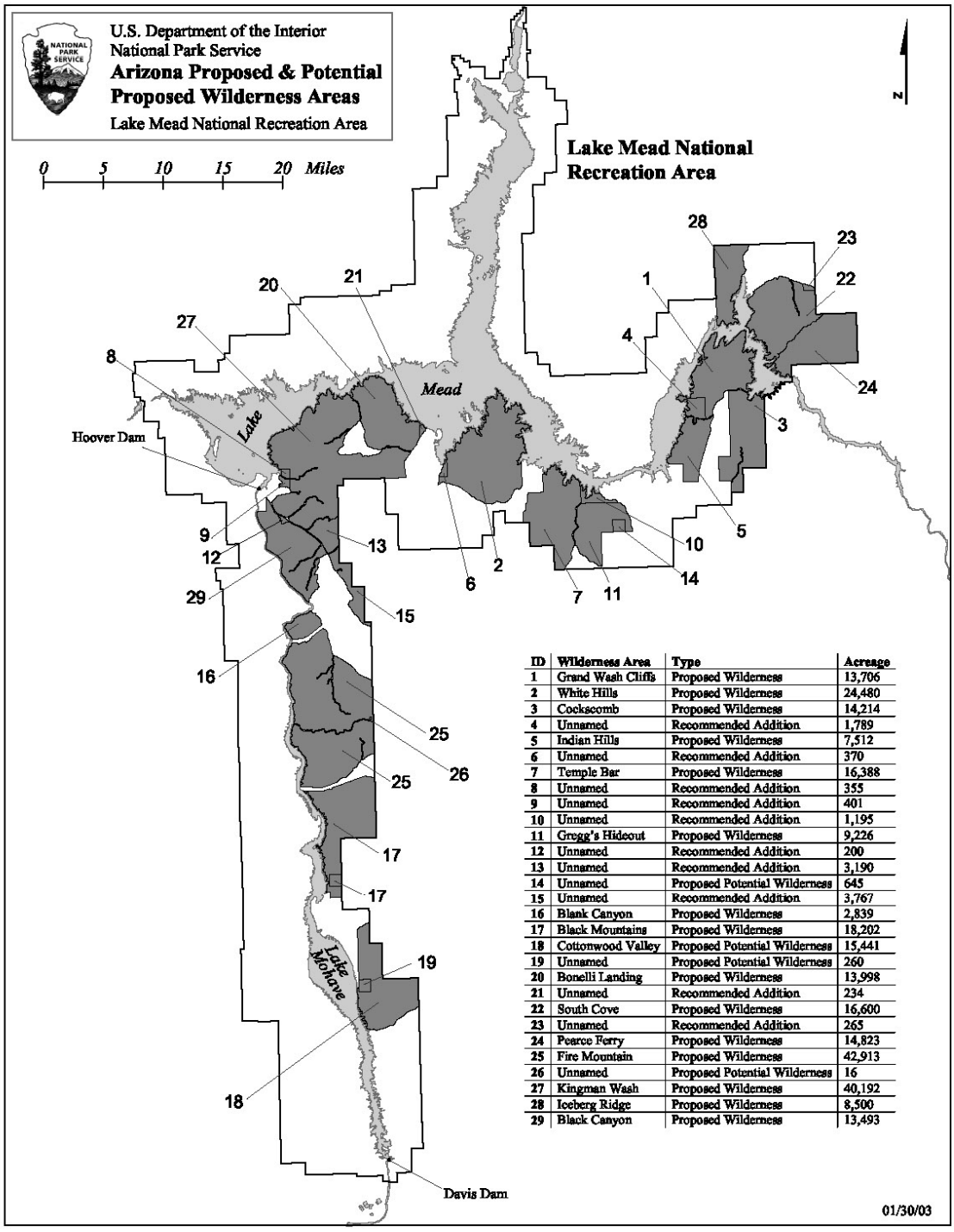
This unit consist of 7,761 acres in the Newberry Mountains, which rise to an elevation of 5,600 feet and offer a cool refuge from the heat of the surrounding desert lowlands. Rugged granite boulders and steep canyons are found through most of the unit. Springs and seeps offer water to wildlife in the area. The area contains huge granite boulders, outcrops, and caves, making this area very scenic. Stands of cottonwood trees can be found along the Grapevine Wash and Sacatone Wash water courses. Numerous archeological resources occur in the area. An outstanding example of petroglyphs is found in Grapevine Canyon. Bighorn sheep, bobcats, and

Figure 16. Designated Wilderness, Lake Mead NRA



Wilderness Area	Type	Acreage
Black Canyon	designated	17,220
Bridge Canyon	designated	7,750
Eldorado	designated	26,250
Ireteba	designated	22,300
Jimbilnan	designated	18,880
Muddy Mountains	designated	3,520
Nellis Wash	designated	16,423
Pinto Valley	designated	39,173
Spirit Mountain	designated	32,914

Figure 17. Proposed and Potential Wilderness in Arizona, Lake Mead NRA



ID	Wilderness Area	Type	Acreage
1	Grand Wash Cliffs	Proposed Wilderness	13,706
2	White Hills	Proposed Wilderness	24,480
3	Cockscomb	Proposed Wilderness	14,214
4	Unnamed	Recommended Addition	1,789
5	Indian Hills	Proposed Wilderness	7,512
6	Unnamed	Recommended Addition	370
7	Temple Bar	Proposed Wilderness	16,388
8	Unnamed	Recommended Addition	355
9	Unnamed	Recommended Addition	401
10	Unnamed	Recommended Addition	1,195
11	Gregg's Hideout	Proposed Wilderness	9,226
12	Unnamed	Recommended Addition	200
13	Unnamed	Recommended Addition	3,190
14	Unnamed	Proposed Potential Wilderness	645
15	Unnamed	Recommended Addition	3,767
16	Blank Canyon	Proposed Wilderness	2,839
17	Black Mountains	Proposed Wilderness	18,202
18	Cottonwood Valley	Proposed Potential Wilderness	15,441
19	Unnamed	Proposed Potential Wilderness	260
20	Bonelli Landing	Proposed Wilderness	13,998
21	Unnamed	Recommended Addition	234
22	South Cove	Proposed Wilderness	16,600
23	Unnamed	Recommended Addition	265
24	Pearce Ferry	Proposed Wilderness	14,823
25	Fire Mountain	Proposed Wilderness	42,913
26	Unnamed	Proposed Potential Wilderness	16
27	Kingman Wash	Proposed Wilderness	40,192
28	Iceberg Ridge	Proposed Wilderness	8,500
29	Black Canyon	Proposed Wilderness	13,493

Figure 18. Suitable Wilderness in Nevada, Lake Mead NRA

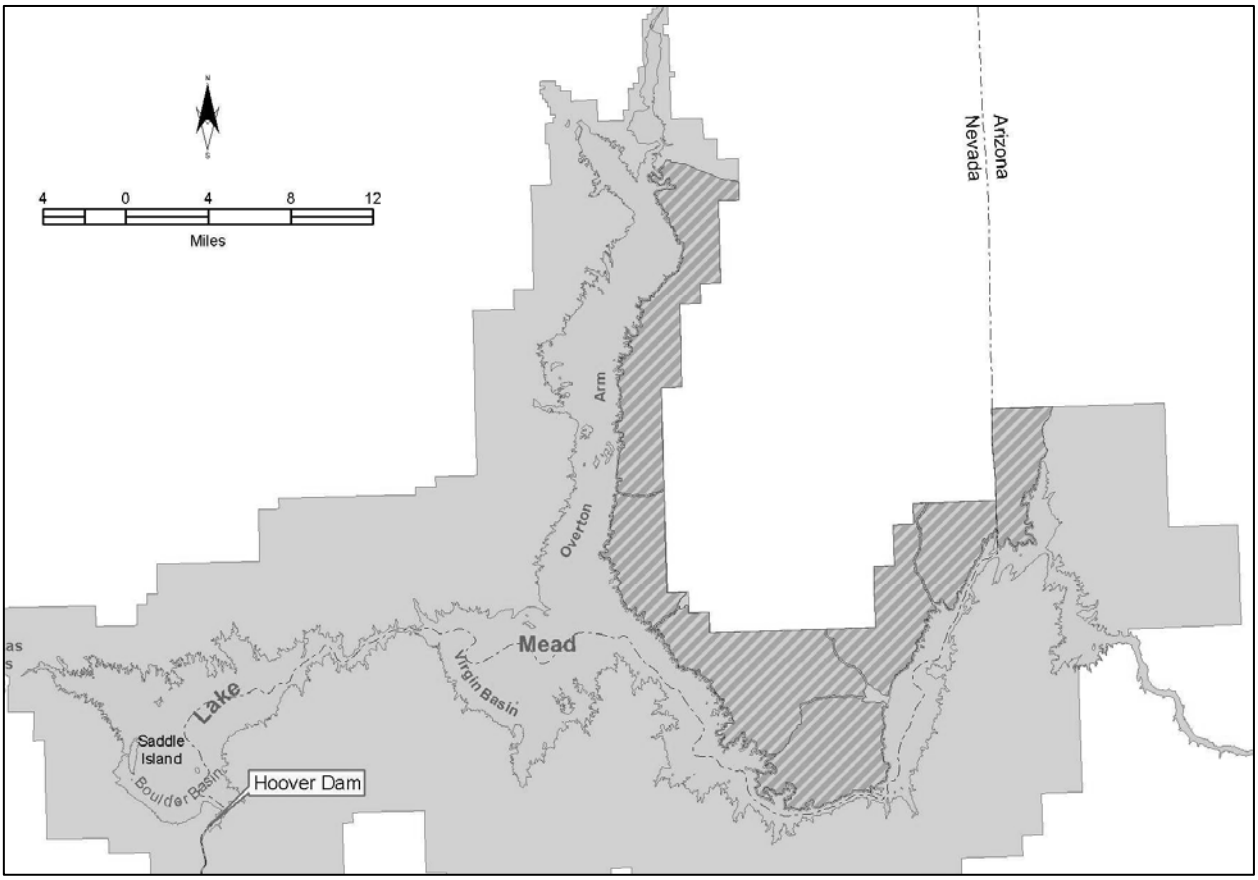
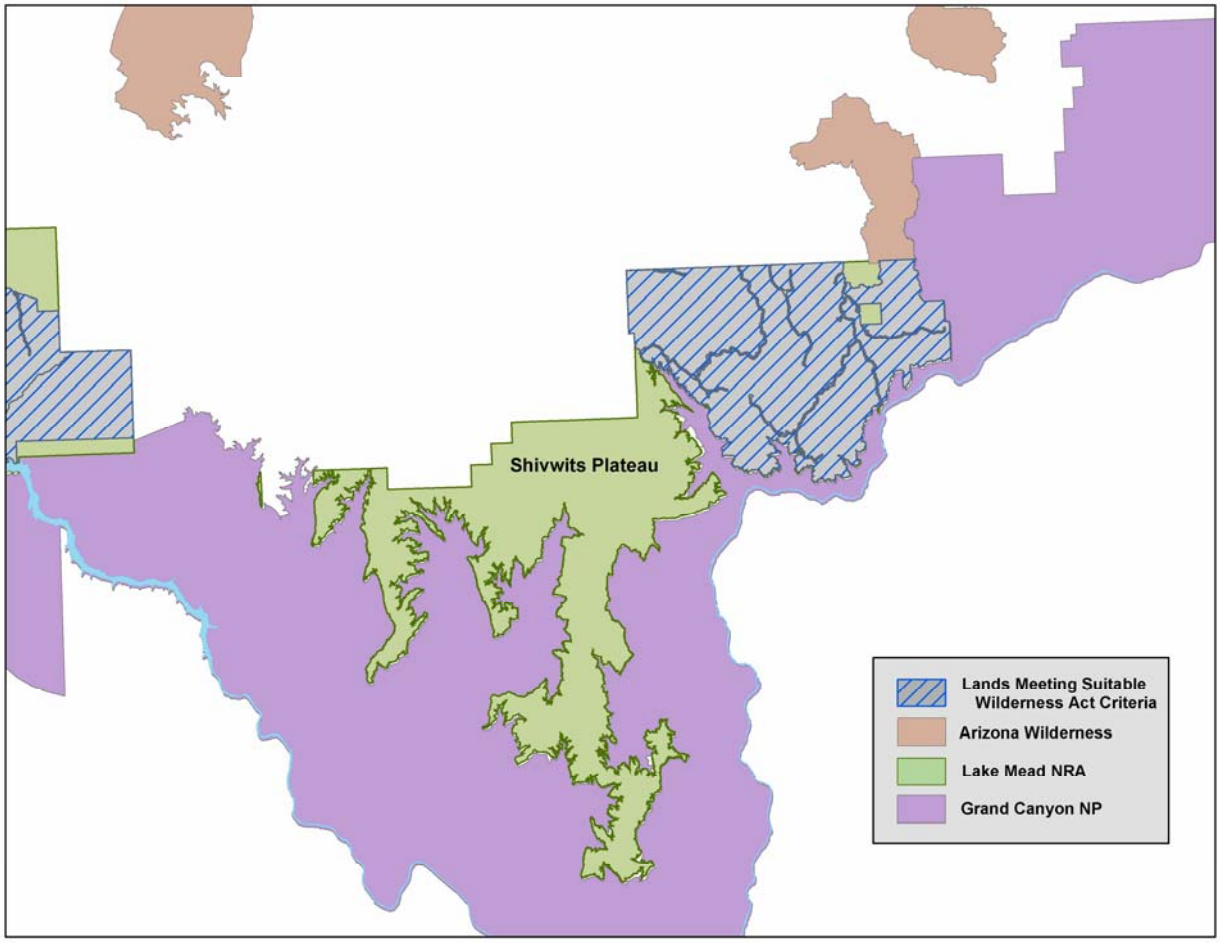


Figure 19. Proposed and Potential Wilderness in the Grand Canyon-Parashant National Monument, Lake Mead NRA portion



coyotes inhabit the area. Reptiles found in the area include Western chuckwalla, side-blotched lizard, Gila monster, and rattlesnakes. The area contains important desert tortoise habitat.

Spirit Mountain Wilderness (Designated)
This 33,518-acre unit is located in the Newberry Mountains. The area contains huge granite boulders, outcrops, and the build of Spirit Mountain. Numerous archeological resources occur in the area. The Spirit Mountain complex is part of a designated traditional cultural property. Bighorn sheep, bobcats, and coyotes inhabit the area. Reptiles found in the area include Western chuckwalla, side-blotched lizard, Gila monster, and rattlesnakes. The area contains important desert tortoise habitat.

Nellis Wash Wilderness (Designated)
This 16,424-acre unit includes portions of the isolated Newberry Mountains along the western side of the recreation area. Fingerlike drainages and alluvial fans extend eastward from the mountains toward Lake Mohave. Some mining has occurred within the unit, as is the case in many areas of the recreation area. However, it is not obtrusive and in effect adds an historic element that is characteristic of the historic west. No active mining occurs within the unit. No water is found in the unit and the summer temperatures can reach 120 degrees. Coyotes, and jackrabbits inhabit the area. Reptiles found in the area include, side-blotched lizard, rattlesnakes, and desert tortoise.

Cottonwood Valley (Proposed Potential)
Cottonwood Valley potentially meets the criteria of the Wilderness Act because of the presence of mineral reservations. This outwash trending to the west provides solitude and isolation in a primitive setting north of a major development at Katherine Landing. This 15,295-acre unit is bounded on the north, south, and west by existing access roads, and on the east by the recreation area boundary. The terrain slopes gently westward toward Lake Mohave.

Black Mountains (Proposed)
The Black Mountains, capped by 2,000-foot Mount Davis, provide the background to users of Lake Mohave. Approximately 17,970 acres are included within this proposed wilderness unit, and 640 acres is proposed potential wilderness due to mineral reservations. Scattered washes and side canyons transect the Black Mountains from east to west as they wind their way to the Colorado River. The Four Corners-Eldorado Transmission Line forms the north boundary, the west boundary is 300 feet from the high-water line of Lake Mohave, the south boundary follows a series of roads of the Cottonwood Valley system, and the east boundary is the recreation area boundary line.

Ireteba Peaks Wilderness (Designated)
Within this 22,300-acre wilderness area is a portion of the Eldorado Mountains, gently rolling hills and washes extending to Lake Mohave. Rugged mountains, secluded valleys, and flat alluvial fans provide opportunities for seclusion and isolation in a setting of scenic splendor. Teddy bear cholla forests, federally designated threatened desert tortoises, and Townsend's western big-eared bats are just some of the unique species present in this unit. This unit contains one of the few populations of the rare rosy two-toned beardtongue located within the recreation area.

Black Canyon Wilderness (Designated)
This 17,220-acre wilderness unit is contained within the picturesque and rugged Eldorado Mountains. The area is a maze of peaks and side canyons with vertical cliffs extending to the edge of the Colorado River. Much of the terrain was formed by volcanism. A 230kv powerline corridor separates this unit from the Eldorado unit. The area contains scenic beauty and some remnants of past mining. Water is scarce in the unit and the summer temperatures can reach 120+ degrees. Archeological resources are found in the area including petroglyphs, lithic scatters, and an intaglio. Bighorn sheep, bobcats, mountain lion, coyotes, and jackrabbits inhabit the area. Reptiles found in the area include, side-blotched lizard, rattlesnakes, and desert tortoise.

Fire Mountain (Proposed and Proposed Potential)
These units contain 53,250 acres of the most spectacular and rugged terrain within the recreation area. They consist of steep barren rocky crags, which begin at an elevation of 645 feet and terminate at an elevation of approximately 2,200 feet. Significant features of these units include the dramatic Fire Mountain, which rises severely from the desert floor, along with sand dunes, deep canyons, large alluvial fans, important desert bighorn sheep habitat, peregrine falcon habitat, and the northern most stand of native palo verde trees in the nation.

Eldorado Wilderness (Designated)
Contained within this 26,252-acre unit are the picturesque and rugged Eldorado Mountains. The unit is a maze of peaks and side canyons with vertical cliffs extending to the edge of the Colorado River. The Eldorado Landing access road forms the southern boundary; the Colorado River/Lake Mohave 300-foot setback constitutes the east boundary, the northeast side is bounded by the Mead-Liberty Transmission Line, and the recreation area boundary forms the west unit boundary.

Kingman Wash (Proposed)
Approximately 35,530 acres are included within this unit. It is bordered on the north by the 300-foot horizontal setback from the high-water line of Lake Mead, on the west by the Kingman Wash area and access road, on the south by U.S. 93 and the Mt. Wilson Wilderness Area managed by the Bureau of Land Management, and on the east by access roads. An area used for intensive recreation and an area which may be needed as a powerline corridor are identified as non-wilderness along the east boundary. The undulating Black Mountains typify the topography of the region. This area provides important habitat for desert bighorn sheep. Access to the unit is provided on all sides by existing road corridors.

Bonelli Landing (Proposed)
This unit comprises 13,875 acres of mainly alluvial fans and separates the hilly mountainous area of unit 13 from the gypsum beds of unit 21. This unit contains some historic mining diggings and some archeological remains in the form of petroglyphs. Access to this unit is primarily by the road to Bonelli Landing and to Temple Bar.

Muddy Mountains Wilderness (Designated)

This unit consists of 3,521 acres of National Park Service administered lands, and 44,498 acres of Bureau of Land Management administered lands, totaling 48,019 acres. The Muddy Mountains region offers shadowy slot canyons, mind-bending geological formations and expansive views of Lake Mead. Solitude and silence are as common as the narrow canyons and gravelly washes. The landscape here displays a thriving Mojave Desert habitat of creosote bush, black brush, yucca, Joshua trees and desert willow. Desert bighorn sheep, banded Gila monster and the desert tortoise inhabit the area.

Pinto Valley Wilderness (Designated)
This unit is comprised of approximately 39,175 acres of rugged hills and highly scenic valleys. These units contain Guardian Peak, which is one of the highest peaks within the area. The northern side of Boulder Canyon is formed by these units, where steep cliffs or barren rock enter the waters of Lake Mead in a dramatic fashion. Pinto Valley is formed within these units and exemplifies a much photographed topography due to the red sandstone at outcroppings which merge with the green desert vegetation and the grays, browns, and yellows of the desert floor. This area has known populations of the rare Las Vegas bearpoppy.

Jimbilnan Wilderness (Designated)
This 18,880-acre unit is bounded on the north by the Echo Wash Access Road, on the east by the 300-foot setback from the high water line of Lake Mead, on the south by an access road, and on the west by Northshore Road and the Boathouse Cove access road. Mountainous terrain representing the northeast extremities of the Black Mountains dominates the area and contrasts directly with the flat surface of Lake Mead. The sand dunes in this area are known habitat for two rare plants, the Beaver Dam milkvetch and the sticky buckwheat.

Overton (Proposed)
Most of this 24,040-acre unit consists of flat to "badland-like" lands sloping westward from mountainous terrain to a road corridor east of the recreation area boundary. The unit forms the scenic background for lake users, and for shoreline users on the west side of Overton Arm. These flat washes lack the spectacular contrasts found within other units. This unit has a typical desert landscape. It has retained its primitive condition, and affords an opportunity for seclusion and an unconfined type of recreation. This area contains populations of the rare Las Vegas bearpoppy.

On the north, the unit is bordered by the Fisherman's Landing access road on the east by the recreation area boundary, on the south by the Catclaw Access Road, and on the west by the 300-foot setback from Lake Mead.

Arizona Strip (Proposed) (A portion of these units are in Grand Canyon-Parashant National Monument)
These units are known as Twin Springs, Scanlon Wash, Hiller Mountains, Hell's Kitchen, Indian Hills, Cockscomb, Grand Wash Cliffs, Iceberg Ridge, South Cove, and Pearce Ferry. The units contain rugged mountain ranges which provide a scenic background for the Virgin Basin of Lake Mead. Gently sloping outwash fans extend from the mountain fronts to plunge abruptly into the reservoir.

The units are bounded by a network of roads that provide access to developed areas or the lakeshore, by recreation are boundaries, and the lakeshore setback. The interior portions of these wilderness units are readily accessible from adjacent roads. Units 13 through 22 contain a total of approximately 138,755 acres.

White Hills, Temple Bar, and Gregg's Hideout (Proposed)
These proposed wilderness units are located within the White Hills. This rolling hill country includes some evidence of earlier historic mining activities and trails associated with these efforts. The early methods of mining did not scar the area excessively and many scars have healed to the point of not being noticeable. However, areas further to the west are not proposed as wilderness because they have been severely scarred by modern exploration techniques and road construction. Isolation, seclusion, scenic views and historic significance characterize the proposed wilderness. Unit 21, with unique gypsum soils, contains significant populations of the rare Las Vegas bearpoppy.

Unit boundaries consist of access roads, setbacks from Lake Mead, development areas and recreation area property lines. Access to the area is possible from existing roads, hiking from developed areas such as Temple Bar, or by boat from Lake Mead. These three units contain a total of approximately 52,130 acres.

Shivwits Plateau - Proposed Potential (Grand Canyon-Parashant National Monument)
Approximately 83,980 acres are included within this unit. A diversity of activities occur in this remote section of Lake Mead, ranging from hunting to grazing. Due to a higher altitude, the region is cooler, has more precipitation, and supports pinyon/juniper and ponderosa pine forests. Therefore, it also contains a wider variety of wildlife, including mule deer. The sole population of Grand Canyon rose known to exist within the recreation area is located in this unit. Hunting is a favorite recreational pursuit and probably accounts for the majority of the visitation to the area. Additional recreational activities include nature study, camping, exploring with four-wheel drive vehicles, and hiking the superlative rim country. Kelly Point, Twin Point, and other points along the rim permit spectacular views of the Grand Canyon.

Because there are (66,350) acres of land within this unit that are subject to mineral reservations, the unit only potentially meets the criteria of the Wilderness Act.

Unit boundaries follow rims, internal access roads, and recreation area boundaries. Several of the units may appear to be narrow and splintered by access roads. However, when considered along with the adjacent proposed wilderness in Grand Canyon NP, it is apparent that these would form a significant contiguous wilderness unit.

Andrus Point, Unit 35 - Whitmore Point, and Unit 36 - Lava (Grand Canyon-Parashant NM)
These three proposed wilderness units consist of approximately 58,430 acres in the northeast sector of the recreation area. Contained within these units are Parashant, Andrus, and Whitmore Canyons; all are precipitous side canyons of significant grandeur that drain into the Grand Canyon. The entire area is undeveloped land retaining its primeval character with the imprint of humans substantially unnoticeable and provides an opportunity for solitude or a primitive and unconfined type of recreation in a scenic setting of steep escarpments, colorful redwalls, and deep canyons.

Geologic formations and processes in evidence here may provide information on the origin of the Grand Canyon, which is of interest to the scientific and educational communities. Also of interest to these communities are the archeological sites of several Indian cultures, including the Virgin Anasazi and more recently the Paiutes.

Grazing has occurred in this region for over a hundred years and the Lake Mead enabling legislation identifies grazing as an acceptable use. Roads and tanks or water pockets that are necessary for current grazing operations are excluded from the wilderness proposal. All of the roads in this area and on the Shivwits Plateau serve dual roles providing access for recreation and for grazing support purposes.

Wilderness unit boundaries consist of road systems, recreation area boundaries, and plateau rims. Adjacent primitive areas of Grand Canyon NP were considered while deriving this wilderness proposal for Lake Mead. The areas are contiguous unit of primitive lands extending westward from the Pine Mountains across the Sanup and Shivwits Plateaus to the Grand Wash Cliffs.

CULTURAL RESOURCES
The cultural resources of Lake Mead NRA represent a broad spectrum of time, peoples, and endeavors. The recreation area comprises approximately 140 miles of the western Colorado River, which has played a central role in human affairs for thousands of years and continues to the present. Although many archeological sites now lie beneath the waters of Lakes Mead and Mohave, more than 1500 known archaeological sites in the recreation area provide evidence of at least 5,000 years of human occupation. Four archaeological complexes, the Grand Wash archaeological district, the Overton Beach archaeological district, Lost City archaeological sites, and the Grapevine Canyon petroglyphs are listed on the National Register of Historic Places.

Cultural resources from the historic past are just as rich and varied. Cultural materials relating to ranching, mining, exploration, enterprise along the Colorado and Virgin Rivers, Mormon settlement, and structures relating and the construction of the Hoover Dam are found on Lake Mead land. This includes over 55 structures on the List of Classified Structures and seven sites on the National Register of Historic Places. The National Register sites include the Homestake Mine, Grand Gulch Mine-St. Thomas Freight Road, Horse Valley Ranch, Ringbolt Rapids, Quartette Mining Company Railroad Grade, Willow Beach Gauging Station, and the U.S. Government Railroad Grade.

Prehistoric Overview

Prehistory of the Lake Mead area spans most of the accepted period of human occupation in the Southwest. Evidence of human presence from the Paleo-Indian period to historical contact with the Southern Paiute has been recovered. Various publications provide in-depth discussions of Culture History applicable to the Lake Mead NRA lands. These include numerous overviews of Paleoindian and Archaic occupation of the Great Basin and adjacent areas (Jennings and Norbeck 1955; Hester 1973; Jennings 1978; Berry and Berry 1986; and others); cultural sequences for the Ancestral Puebloan (Harrington 1927; Shutler 1961; Lyneis 1995; and others) and Patayan occupation (Rogers 1945; Schroeder 1957, 1960; McGuire and Schiffer 1982; and others).

The Paleo-Indian Period (11,000 B.C. to 7000 B.C.)

The Paleoindian period represents the earliest accepted presence of humans in North America with recorded remains dating back 12,000 to 9,000 years ago. The environment was cooler and moist with lakes, wetlands, and forests covering much of the area. The classic model of Paleoindian lifeways presents these early Americans as "big game hunters" who exploited existing Pleistocene megafauna such a sloth and mammoth. Recorded Paleoindian remains are sparse in general and nonexistent on the Lake Mead NRA land. However, a few scattered artifacts from the Paleo-Indian period have been found on the Arizona Strip and in southern Nevada (Miller 1979; Fairley 1989). Minimal evidence has been recovered from Tule Springs north of Las Vegas, Nevada that indicates human occupation of the area between 11,000 and 8,000 B.C. (Wormington and Ellis 1967).

The Archaic Period (7000 B.C. to 300 B.C.)

The Archaic Period is generally considered to represent cultural adaptations to the more arid times following the glacial retreat signaling an end to the Pleistocene. Changing environmental conditions resulting in shifting subsistence strategies throughout North America marks this period. A non-sedentary hunting and gathering lifestyle characterized the Archaic Period in the Post-Pleistocene western North America. This cultural model suggests a general, widespread adaptation to an arid environment over a long span of time resulted in the lifeway of small socio-political units in a sparsely populated habitat, focused on intensive exploitation of a wide range of resources.

Several sites in the Great Basin have produced evidence of an early archaic lacustrine lifestyle. There are questions as to whether the hunting and gathering lifestyle developed from this lacustine adaptation, or from a concurrent eclectic foraging adaptation (Hester 1973). Recent research suggests a subsistence strategy revolving around exploitation of specific, seasonally abundant resources, rather than intensive exploitation of all available resources, shaped the archaic lifestyle. The seasonal round may have been geared towards the strategic harvesting of specific resources when they were most abundant (Fairley 1989). Identifiable shifts in projectile point morphology are used to divide the Archaic Period into three temporal subdivisions (Holmer 1986) based loosely on climatic changes defined by Antevs (1955, 1962).

Western Ancestral Puebloan Period (300 B.C. to 1200/1225 A.D.)

The Formative Period represents the occupation of the Virgin River area and Shivwits Plateau by pueblo dwelling people. Around 300 B.C. the inhabitants of the Shivwits Plateau and the Virgin and Muddy River drainages began supplementing their diets with cultigens. Farming encouraged a more complex, sedentary life. This period is characterized by the development of settled villages, introduction of ceramics, and the bow and arrow. Whether this shift in subsistence strategies represents Mexican and Southwestern influences on Archaic groups (Aikens 1966; Jennings 1978), or a population movement from the East or South still represents an important research issue (Westfall 1987; Fairley and Geib 1989).

Investigations at the Lost City in southern Nevada initially defined the Virgin area pueblo cultural sequence (Shutler 1961). Ceramic styles that are similar to the Kayenta area ceramics, site layout, and architecture were used to define the cultural sequence for the Virgin area. Although design elements for ceramics differ slightly, they are similar enough for researchers to apply the chronology developed for the Kayenta area based on tree-ring dates (Colton 1952). Virgin area ancestral puebloan cultural traits are similar to the general pueblo cultural patterns, although adaptations to the Great Basin environment differ from the puebloan adaptations on the Colorado Plateau. Data from the Kanab site excavations suggests the Virgin area ancestral puebloan people relied on a mixed subsistence economy based on agriculture and supplemented by the collection of wild flora and fauna (Nickens and Kvamme 1981).

From A.D. 900 - 1150 the Virgin area puebloan people appear to have carried on extensive local and regional trade in turquoise, salt, and cotton. The time period A.D. 1050 to 1150 represents the peak population on the Arizona Strip (Teague and McClellan; Westfall 1987). The collapse of the Pan-southwestern trade system may have led to the demise of the Virgin area ancestral puebloan people and abandonment of the western Arizona Strip and southern Nevada area (Rafferty 1990). The Moapa Valley and Shivwits Plateau appear to have been abandoned 100 to 150 years before other Puebloan areas in the Southwest (Harrington 1930; Moffitt and Chang 1978) and was followed immediately by Paiute occupation (Fairley 1989; Wells 1991).

Around A.D. 1000-1300 the Paiute and other numic speaking groups expanded their range and may have out-competed the puebloan people for wild resources during especially dry periods (Madsen 1975). Puebloan abandonment of the area may be the result of direct competition with the Paiute (Steward 1933; Euler 1964), or indirect competition over wild food resources (Madsen 1975; Bettinger and Baumhoff 1982). Other researchers believe Puebloan abandonment on the Colorado Plateau was the result of changing environmental conditions (Euler et. al. 1979; Dean et. al. 1985). Of course a combination of competition with the Paiute, changing environmental (Jett 1964; Madsen 1975) and socioeconomic conditions (Rafferty 1990) may represent a more likely scenario.

The Patayan (Amacava/Cerbat).

The cultural pattern along the lower Colorado River following the Archaic Period is generally referred to as “Patayan” (McGuire and Schiffer 1982). The Patayan cultural pattern is first recognized in the region with the introduction of pottery and flood plain agriculture around 700 A.D. A pre-ceramic phase is marked by the introduction of Desert Side-notched and

Cottonwood type projectile points around 500 A.D. Burial also changed from extended inhumations to cremations during this time (Tierra Environmental Services, Inc. 1995).

The Patayan cultural pattern consisted of dispersed small mobile groups living in villages along the lower Colorado River floodplain. Their habitation included brush huts, rock outlined jacal structures, semi-subterranean earth houses, and simple ramadas. Long range travel is marked by the presence of a network of trails and associated shrines, and broken pottery (Rogers 1945; Schroeder 1957, 1960). Although floodplain agriculture was practiced, they obtained 40 to 70 percent of their subsistence from wild foods (Castetter and Bell 1951).

Three phases of the Patayan ceramic-period cultural pattern are visible in the archaeological record. In first phase begins around 700 A.D. and is marked by the introduction of ceramics and appears to be confined to the lower Colorado River. The second phase begins around 1050 A.D. and is associated with the infilling of Lake Cahuilla. During this time the lacustrine habitat was occupied by ceramic producing people filtering in from the lower Colorado River area. The third phase began with the recession of Lake Cahuilla around 300 to 500 years ago (McGuire and Schiffer 1982). The Patayan cultural pattern is reflected historically by groups inhabiting the lower Colorado River and speaking Yuman family languages.

Table 4. Temporal Sequence for the Culture History of the Lake Mead Area

Dates	Ezzo (1995)		Lost City Phases (Shutler 1961)	Fairley (1989)		Pecos System (Plog 1997)
1700	Proto-Historic		Proto-Historic	Proto-Historic	NeoArchaic	P V
1600			Paiute	Paiute		
1500	Late Prehistoric					P IV
1400						
1300						P III
1200				Early PIII		
1100	Mesa House	Saratoga Springs	Mesa House	(Late PII)	Formative	
1000	Lost City		Lost City	(Early PII)		P II
900				(Late PI)		
800				(Early PI)		P I
700	Muddy River		Muddy River	BM III		
600						BM III
AD 500	Moapa		Moapa			
0				BM II		BM I
500 BC	Gypsum					Archaic
1000			Pinto-Gypsum	Late Archaic	Archaic	
2000						
3000				Middle Archaic		
4000	Pinto		Corn Creek Dune			
5000				Early Archaic		
6000	Lake Mojave		Hiatus			
7000						
8000				Paleo-Indian		
9000			Las Vegas			
10,000			Tule Springs			
13,000						

Ethnographic Overview

Lake Mead NRA and Parashant NM encompass an area that was home to many different Native American groups at the time of Euro-American contact. The Arizona Strip area and parts of Southern Nevada were occupied by various groups speaking Numic-family languages generally referred to as the Southern Paiute. The Colorado River drainage was inhabited by groups speaking Yuman-family languages. There are several good ethnographic overviews available for an in-depth discussion for the Southern Paiute (Kelly 1964; Euler 1966; Kelly and Fowler 1986) and the groups speaking Yuman-family languages (Rogers 1945; Ortiz 1983; Stoffle et. Al. 1998).

The Southern Paiute.

Following the withdraw of the ancestral puebloan people, groups speaking Numic-family languages occupied the Great Basin and Arizona Strip area. Linguistic (Hopkins 1965) and archaeological evidence suggests the arrival of groups speaking the Numic-family languages in the southern Great Basin about 800 to 1000 years ago (Euler 1964; Hopkins 1965). The Southern Paiute are the Numic group that occupied the Arizona Strip and Southern Nevada area and were present at contact with the first Euro-americans.

The Southern Paiute were desert adapted and practiced a hunter-gatherer lifestyle exploiting a wide variety of resources. These include many high-cost, low-return food resources such as small seeds (Bettinger and Baumhoff 1982). Habitation structures consisted of a framework of tree limbs with a brush covering. Caves were used as shelter during the winter in some areas. Pottery was produced by some groups, but the primary craft was basketry with various forms manufactured and suited to local needs (Kelly and Fowler 1986).

The Southern Paiute practiced a seasonal round obtaining food resources from differing environmental zones at the times when the food resources were the most abundant. During the late summer and autumn they moved to higher elevations to hunt deer, gather pinyon nuts, berries, and seeds. Extended family groups would aggregate to conduct rabbit drives and conduct communal hunts for bighorn sheep and antelope in the valley bottoms. Surplus food resources were cached to sustain them through the winter. The extended family groups would split off into smaller groups during the winter and move to lower elevation base camps (Kelly 1964).

The Yumans.

Cultural materials left behind by the riverine adapted Yuman-speaking people are found in the Lake Mojave area and the southern portion of Lake Mead. Archeological materials indicate this cultural group has occupied the same area for an extended period of time (McGuire and Schiffer 1982). The prehistoric materials are generally referred to as belonging to the Patayan culture (Schroeder 1957, 1960). However, the Archeological Record suggests the existent tribes such as the Mojave and Quechan are the direct descendants of the prehistoric inhabitants.

The Yuman-speaking tribes practiced less intensive forms of horticulture taking advantage of seasonal flooding of the Colorado River to irrigate their crops. Successful harvests, however, were variable and most of these groups continued to rely heavily on seasonal hunting and

gathering. When available, horticultural products provided a valuable supplement to native resources. This flexible combination of subsistence strategies continued to be used successfully into historic times.

The Yuman-speaking groups lived in small family units centered around rancheria type settlements that included brush structures and ramadas. These family units were organized into larger tribal units that would function together in times of conflict with other tribes (Ortiz 1983).

Historic Overview

Spanish missionaries were the first Euroamericans to visit the region during the 18th century. Later came Euroamerican trappers and explorers such as Jedediah Smith and James O Pattie. The exploration and opening up of the Colorado River to steamboats during the 1850s and 1860s permitted the supplying of military posts, mining camps, and early Mormon settlers. The mid-1860s through the turn-of-the-century saw a series of mining booms in Black Canyon and elsewhere in the park. By the 1880s, ranching gained importance on the Shivwits Plateau. Hoover Dam was constructed in the 1930's and continues to provide electric power, water, and recreational opportunities.

The Shivwits Plateau

The Shivwits Plateau was most likely first explored by Euro-americans James O. Pattie and his expedition in 1827. Mormon missionaries made subsequent contact with the native Paiute in the vicinity. In 1862, James H. Pearce brought a band of about 300 Paiute to St. George to be baptized. However, the best documented of these initial explorations was the ill-fated journey of three members of the Powell expedition in 1869 (Belshaw and Peplow 1980). These men were members of the expedition led by John W. Powell to explore the Colorado River in its course through the Grand Canyon. They decided to leave the expedition at what is now known as Separation Canyon and try their luck with an overland route when they lost faith in the practicability of the riverine route. Unfortunately for the three members of the Powell expedition, an encounter with a band of Paiute resulted in their deaths (Powell 1961).

Accessibility to the Shivwits was greatly enhanced by the construction of the Grand Gulch Mine access road. The Grand Gulch Mine was opened in the late 1800s, and timber and beef requirements were met by logging and ranching on the Shivwits. The logging industry took advantage of the stands of Ponderosa pine available on the Shivwits Plateau including sawmills in the Green Spring area. Ranching started with the Parashant Ranch in 1879 established primarily to supply the needs of the Grand Gulch Mine. Other cattlemen followed including Slim Waring who established the Waring Ranch in Horse Valley and eventually gained control of the all the lands out to the end of Kelly Point (Belshaw and Peplow 1980).

A portion of the present Lake Mead NRA was once part of the Dixie National Forest. In 1916, President Wilson removed the Parashant Division from the national forest and opened it to homesteading. Few chose to homestead in the area, although it was during this time that Slim Waring established the Waring Ranch in Horse Valley. Pine Valley was homesteaded in 1926 by George H. Pemberton who later sold his rights to Slim Waring. The Pine Valley cabin was constructed c.a. 1909, although it was never completed. It is uncertain whether the cabin was

ever used for human habitation. Physical evidence suggests the cabin was a line shack and used for storing hay (Belshaw and Peplow 1980; N.P.S. 1983).

Lakes Mead and Mohave

Southern Nevada was most likely first explored by Spanish or Mexican adventurers in the eighteenth century. The first documented exploration by Euro-Americans was by Jedediah Smith in 1826. Traders and trappers arrived in the area following the initial exploration. In the mid-nineteenth century emigrant wagon trains ran into trouble with Mojave braves resulting in stationing of U.S. Army troops at Fort Mojave and in El Dorado Canyon. Morman settlers arrived later and established communities in the area (Belshaw and Peplow 1980). The discovery of gold and silver resulted in increased mining activity in the second half of the nineteenth century (Vanderburg 1937).

Historically mining in the Lake Mead area has occurred in the mountains surrounding Lakes Mead and Mojave. The earliest miners in southern Nevada were Native Americans who extracted turquoise and salt for trade. However, Franciscan monks operated a lead mine in the middle of the eighteenth century marking the earliest Euro-American mineral extraction operation in the area. The first systematic mining in Clark County, Nevada occurred in 1857 when silver and gold were extracted from the El Dorado mining district.

The late nineteenth century saw major mining activity with mines operating in the Goodspring District and near the town of Searchlight, Nevada. In 1905 the San Pedro, Los Angeles & Salt Lake Railroad was completed and the town of Las Vegas was established. The completion of the railroad stimulated the economy resulting in increased mining activity. The onset of World War I inflated the price of base metals resulting in the period of greatest mining activity for the region (Vanderburg 1937).

The construction of Hoover and Davis Dams signaled the greatest human impact on the park's desert environment and the beginning of the park's role as a major recreational area in the southwest. Hoover Dam itself is a National Register Landmark and there are numerous historic period sites relating to dam construction and electric power generation.

Impoundment of the Colorado River transformed a riverine environment to a lacustrine one. The recreational potential of the lakes has resulted in the granting of recreational concessions in various areas of the park. One of the earliest recreational concessions was established near Meadview, Arizona and included an airstrip. This concession area is no longer maintained, but is marked by archeological remains dating to the Great Depression Era.

Archeological Resources

Two overviews of archeological research in the park exist (Brooks et. al 1977; Ervin 1986). Both summarize research through the late 1970s and early 1980s. Early excavations at Lost City and Willow Beach are reported by Harrington (1936), Baldwin (1948), and Schroeder (1950). Early surveys also were conducted on the Shivwits Plateau (Baldwin 1942), Lake Mohave (Baldwin 1943, Tuthill 1949; Schroeder 1950) and in many of the park's proposed development areas by Brooks et. al (1974). The park's developed areas were later inventoried by Ervin (1986).

More contemporary investigations include Lyneis's (1991; 1992) re-assessment of Pueblo Grande de Nevada (Lost City), Wells' (1991) survey of the Shivwits Plateau, and Fox's (1993, 1994) survey of the Newberry Mountains area. An historic resources study was completed in the 1980's (Belshaw 1980; Scrattish 1982). Finally, through a partnership with the Harry Reid Center, Section 110 inventories were carried out in the Bowl of Fire (Blair, n.d.).

Although much research has occurred, understanding of the recreation area's cultural resources currently is hampered by a lack of documentation and accessibility. Less than 1% of the park has been archaeologically surveyed. Rugged terrain and a harsh environment restrict access to many resources, while inundation of the Colorado River obscures still others.

Prehistoric Sites

To date 1500+ archeological sites have been recorded within the park. These include over 1400 prehistoric sites and approximately 108 historic sites. In addition, 55 structures currently are listed on the park's List of Classified Structures (LCS). The park's Historic Resources Study (HRS) identifies another 189 structures, sites, roads, and features. Combined, these different information bases identify some 1700+ in situ cultural resources located in the park.

Examination of the archeological databank indicates that approximately 53% of the prehistoric sites are artifact scatters consisting of lithics, ceramics, or a combination of the two. Another 22% are habitation sites consisting of rock shelters/caves, pithouses/pueblos, and surface sleeping areas. Another 12% relate to mineral extraction in the form of turquoise and salt mining, quarrying, or lithic procurement. Eleven percent of the sites are identified as rock rings or rock alignments, while a final 2% are either petroglyphs and/or pictograph locations.

National Register Properties: Two districts and one site are listed as prehistoric properties on the National Register of Historic Places. These include Pueblo Grande de Nevada (Lost City), Grapevine Canyon Petroglyphs, and Grand Wash Archeological District. Approximately 222 sites are associated with these properties and districts. Lost City and Grapevine Canyon hold regional level significance, while the Grand Wash District is of regional or local significance.

Additionally, the Archeological Site LAME-79-A-1 (Echo Bay), Overton Beach Archeological, and Temple Bar Sites have been determined eligible at the local level. Approximately nine individual sites are associated with these properties.

Historic-period sites

Currently there are approximately 110 recorded historic-period sites. The majority of the recorded historical archeological sites (52%) relate to mining. Specific site types include mining camps, mines, isolated shafts and prospects, stone markers and one arastra. The next most common site entails unidentified habitation sites (23%) which include cabins, campsites, and trash scatters. Transportation related sites (10%) includes railroads, roads, and river features such as ferry locations. Ranching sites (5%) include cabins, barns, corrals, line-shacks, and fences, although some of the unidentified habitation sites also may relate to this category.

Miscellaneous sites (8%) include sawmills, early park concessions, and an inscription scratched into stone on top of Mount Dellenbaugh.

The Historic Resource Study identified approximately 189 historic sites. Site types roughly parallel those of recorded historic sites. Historical documentation for the sites identified in HRS varies considerably. Many of the resources have not been located or recorded in the field. As part of park-wide surveys, these resources should be located and fully assessed for their significance under Criteria A-D of the NHPA.

National Register Properties: Historic properties on the register include the Homestake Mine, Willow Beach Gauging Station Complex, and Horse Valley (Waring) Ranch. In addition, two historic properties have been determined eligible, but have yet to be formally nominated. These include the U.S. Government Construction Railroad and Quarttete Mining Company Railroad. The Government Railroad and Willow Beach Gauging Station have national level significance due to their association with the construction and operation of Hoover Dam, a National Landmark Site. The remaining properties possess regional level significance.

Structures

List of Classified Structures: A total of 55 structures are listed on the LCS (Table 5). These structures relate to the following sites: Willow Beach Gauging Station, Shivwits Plateau Horse Valley (Waring) Ranch, Tassi Ranch, Scanlon Ferry Road and Dugway, Grand Gulch-St. Thomas Road, U.S. Government Construction Railroad, and Quartette Mining Company Railroad Grade.

Historical Base Map/Historic Resources Study: The study summarizes known historic sites, trails, and features in park boundaries (Belshaw 1980). An addendum study offers additional data (Scrattish 1982). Both studies only assess the architectural and historical significance of the recorded historic sites. The site's potentials to yield archeological or scientific information have not been assessed for these sites.

Historic Structure Report: A Historic Structure Report for the Horse Valley Ranch is under preparation. Reports and HABS/HAER documentation are also needed for the U.S. Government Construction Railroad Tunnels and Willow Beach Gauging Station Complex.

Ethnographic Resources

Many Native American groups have direct historic, or indirect prehistoric ties to the Lake Mead NRA managed lands. These include the Southern Paiute Consortium, Las Vegas Band of Paiute, Kaibab Paiute, Mojave, Walapai, Havasupai, Yavapai, Quechan, Chemuevi, Maracopa, Ak Chen, Hopi, Zuni, and Navajo tribes. Culturally sensitive areas such as Spirit Mountain, Willow Beach, and Black Canyon have been identified. Earlier consultation revealed these areas to be culturally and spiritually significant to many of the Yuman-speaking Colorado River Native American groups. In addition, the Willow Beach site has yielded several human burials that may relate to the ancestral puebloan people, Colorado River Tribes, and/or the Southern Paiute.

Other ethnographic resources include those localities that were used traditionally by the identified Native American groups. Resource procurement areas include locations where food resources and basketry, or pottery manufacturing materials were obtained. In particular certain locations were traditional gathering sites for specific family groups over many generations. Unique geo-physical features such as hot springs were also used on a regular basis for ceremonial purposes and/or as a stopping point when traveling. Some of these locations include pictographs or petroglyphs that are considered to be culturally significant.

Traditional Cultural Properties

Consultation with Native American groups suggests that the park may contain a variety of traditional cultural areas and sacred sites. Currently there is one Traditional Cultural Property (TCP) at Lake Mead that is listed on the National Register of Historic Places. Spirit Mountain/Avi Qwa Ame Cultural Property, Clark County, Nevada was listed on the Register on September 8, 1999. The area is culturally and spiritually significant to many of the Yuman-speaking Colorado River Native American groups. Discussions with the Lower Colorado River Indian Tribes identified Spirit Mountain as a sacred site. The TCP is unique and of profound importance to the Yuman-speaking people's ethic identity and spiritual character.

Two other locations with traditional cultural values have been determined eligible for inclusion on the National Register of Historic Places. These are Sugar Loaf Mountain and Gold Strike Canyon, both of which are associated with the "Salt Song Trail." The trail is culturally significant as a physical and spiritual pathway that passes through Lake Mead NRA managed lands. There are numerous geo-physical features including Sugar Loaf Mountain and Gold Strike Canyon that are spiritually significant and guide the traveler along the "Salt Song Trail."

Cultural Landscapes

Increasingly, cultural landscapes and TCPs are being recognized as cultural resources requiring special management. Three Cultural Landscapes with structures on the List of Classified Structures are located on Lake Mead land. These include the Tassi Ranch, US Government Railroad Grade, and Horse Valley Ranch cultural landscapes.

Wildfires, or the use of fire as a management tool, have significant implications in the preservation of cultural landscapes. Large significant features are obvious and management actions for their protection can be easily developed. However, cultural landscapes often include contributing elements that are not so obvious. The Horse Valley Ranch cultural landscape in particular consists not only of the main cabin complex and associated line shacks, but also includes scattered corrals, cattle tanks, and fences that divide the landscape into functional outdoor spaces.

Museum Objects

The recreation area's cultural resources also include extensive museum collections housed in the park and at the Western Archeological and Conservation Center (WACC) in Tucson. These holdings include both reference and interpretive collections. In the future, these collections will become increasingly important sources of baseline data. While there have been accomplishments, there are still many inadequacies for cultural resource management. The

museum collections at the park are currently managed in a sub-standard facility. The park's archeological site records and base map are maintained by WACC.

The park also maintains two libraries. The main library is located at the park's headquarters. Holdings are organized using the NPS library system. This library contains a wide of variety of reference materials focusing on natural and cultural resources, history, geology, paleontology, and other topics pertinent to the park and surrounding region. Archeological and ethnographic technical reports are housed in this library. Reports containing sensitive information are stored in a secured file cabinet. A research library is housed in the Resource Management Division. Organized by the Procite referencing program, this library primarily contains natural resource technical reports. Combined, the libraries contain a wealth of information pertaining to the park.

Finally, the park has an extensive historic photograph collection containing 7,000+ photographs and associated negatives. The photographs have been classified using the NPS photographic classification system. The photographs record construction and park operation activities from ca. 1935 to the early 1980s. This information will be valuable in developing a park administrative history.

Summary of Cultural Resources by Fire Management Units

Table 5 summarizes cultural resources data for the fire management units defined in alternative C. The totals are derived from recently developed geographic information system (GIS) and other databases maintained by the Cultural Resource staff at Lake Mead NRA. A great number of cultural resources data still reside with other agencies and institutions, and have yet to be integrated into these databases. Likewise, much of the archeological data collected in the early to mid-1900s lack good locational information, and could only be included in this analysis with great difficulty. As such, the numbers presented here may not be totally accurate. Still, the available information probably reflects the relative state of cultural resource inventory in each fire management unit.

Many of the interface areas comprising FMU-1 have at least a moderate amount (>25%) of documented survey, and a number contain cultural resources. Survey in FMU-2 is patchy, with those areas closest to developed areas and roads receiving the most coverage. Not surprisingly, cultural resource distribution largely mirrors the survey pattern. Recent survey for prescribed burns has greatly expanded inventory in FMU-3, and recognition of a very high density of cultural resources.

Due in large part to different environmental conditions, land-use histories, the cultural resources represented in each Fire Management Unit are quite different. The contrast is greatest between Fire Management Units 1 and 2 and Fire Management Unit 3. With a few exceptions, prehistoric archeological resources in the former are dominated by lithic scatters and quarry sites. Petroglyphs are also well represented. Structural remnants, agricultural features and more complex artifact scatters (often containing ceramics) are common in Fire Management Unit 3, while petroglyphs are rare. Historical archeological resources, structures, and cultural landscapes in Fire Management Units 1 and 2 reflect the importance of mining and water

developments, while cattle ranching and logging are the predominant themes on the Shivwits Plateau.

Table 5. Lake Mead NRA Survey Areas

Fire Management Units	**% of Area Surveyed[1]**	**Archeological Sites[2]**	**Historic Structures [3]**	**Cultural Landscapes & Ethnographic Resources[4]**
FMU-1—Interface				
Davis Dam	38%	2	--	--
Katherine Landing	58%	--	--	--
Princess Cove	83%	--	--	--
Katherine Mine	4%	--	2	1
Cottonwood Cove	38%	5	1	1
Nelson's Landing	14%	3	--	--
Willow Beach	71%	8	--	1
Boulder City	1%	--	2	1
Boulder Beach & Marina	88%	16		2
Las Vegas Bay	82%	--		1
Lake Los Vegas	32%	--	--	--
Callville Bay	100%	10	--	--
Stewarts Point	51%	--	--	--
Echo Bay	94%	1	--	--
Overton	--	10	--	--
Hoover Dam	29%	9		5
Temple Bar	32%	2	--	--
Meadview	--	--	--	1
Tassi Ranch	--	1	7	1
Jumbo Mine Area	2%	--	--	--
Blue Point Spring	92%	--	--	--
Rogers Spring	86%	4	--	--
Lake Mojave View Ranchos	48%	2	--	--
FMU-2—Desert	4%	382	14	16
FMU-3—Shivwits	7%	181	23	9

1 Approximate percentage of area surveyed for cultural resources.
2 Includes archeological sites with UTM coordinates in the Lake Mead NRA Archeological Sites Management Inventory System (ASMIS).
3 Structures listed on the Lake Mead NRA List of Classified Structures (LCS).
4 Cultural landscapes from the National Park Service, Pacific West Region, Cultural Landscape Inventory Report.

SECTION IV: ENVIRONMENTAL CONSEQUENCES

METHODOLOGY

The environmental consequences section analyzes both beneficial and adverse impacts that could result from the three alternatives. Impacts are evaluated based on context, duration, intensity, and whether they are direct, indirect, or cumulative impacts.

Assumptions for Impact Analysis

This section contains the environmental impacts, including direct and indirect effects and their significance to the alternatives. The analysis is based on the assumption that the mitigation identified in the *Mitigation and Monitoring* section of this environmental assessment would be implemented under any of the applicable alternatives, as identified in each mitigation criteria.

Impacts are evaluated based on the most current and comprehensive scientific and social data available. All the information was not generated at Lake Mead NRA, but certain information from other areas can be used to determine potential impacts within the recreation area. Considerable information was available on the effects of fire and fire suppression. Much of the information found was generated by either the Lake Mead NRA biologists, resource management specialists whose focus is on vegetation, archaeologists, and prescribed fire specialists. Follow-up contacts with these specialists were made to assist with interpreting the information, and to provide additional information related to impacts from fire and suppression activities on natural resources and the visitor experience. In the absence of quantitative data, best professional judgement prevailed.

Certain impacts, such as long-term impacts to ecosystems from fire, are difficult to determine, and criteria has been developed through research and monitoring of prescribed fire effects, particularly to pinyon-juniper and ponderosa pine communities, conducted over the last decade throughout many land management agencies. The impacts of the vegetative treatment program, which includes prescribed fire, were analyzed in detail in the attached Vegetative Treatment Program Environmental Assessment (Appendix A) and will not be further analyzed in the following section.

There are several terms used within the environmental consequences section to assess the impacts of each alternative on each impact topic. Unless otherwise stated, the standard definitions for these terms are:

Negligible - the impact is at the lower level of detection; no measurable change would occur.

Minor - the impact is slight, but detectable; a small change would occur over the life of the plan.

Moderate - the impact is readily apparent; a measurable change would occur and could result in a small but permanent change.

Major - the impact is severe; a permanent measurable change of at least 15 percent over the life of the plan would occur.

Impairment - the impact would harm the entire integrity of the resource or value, whose conservation is key to the cultural or natural integrity of the recreation area, or is a resource or value needed to fulfill a specific purpose identified in the park's enabling legislation.

Localized Impact - the impact occurs in a specific site or area, individual wildlife, or the wildlife group. When comparing changes to existing conditions, the impacts are only detectable in the localized area.

Short-term - the impact occurs only during or immediately after the actual management activity.

Long-term - the impact could occur for an extended period of time after the management activity has been completed. The impact could take several years or more and could be beneficial or adverse.

IMPAIRMENT ANALYSIS

In addition to determining the environmental consequences of the alternatives, NPS *Management Policies* (2001) requires the analysis of potential effects to determine if actions would impair park resources. Under the NPS Organic Act and the *General Authorities Act*, as amended, the NPS may not allow the impairment of park resources and values, except as authorized specifically by Congress. The NPS must always seek ways to avoid or minimize, to the greatest degree practicable, adverse impacts on park resources and values. However, the laws do give the NPS management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, as long as the impact does not constitute impairment to the affected resources and values (*Management Policies* 1.4.3).

Impairment to park resources and values has been analyzed within this document. Impairment is an impact that, in the professional judgement of the responsible NPS manager, would harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values. An impact would be more likely to constitute an impairment to the extent that it effects a resource or value whose conservation is necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park; is the key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or is identified as a goal in the park's general management plan or other relevant NPS planning documents. An impact would be less likely to constitute an impairment to the extent that it is an unavoidable result, which cannot be reasonably further mitigated, of an action necessary to preserve or restore the integrity of park resources or values.

Criteria and Thresholds for Impact Analysis

This section provides a description of the related laws, regulations, and policies for each impact topic, and the methodology and thresholds used in the impact analysis. The same methodology and general criteria were used for each impact topic. Certain impacts, such as visitor experience, are difficult to determine, and criteria have been developed through the visitor use and carrying capacity surveys that have been conducted within the recreation area.

Vegetation and Soils

Related Laws, Regulations, and Policies: The NPS *Organic Act* directs the park to conserve the scenery and the natural objects unimpaired for future generations. Soil resources will be protected by preventing or minimizing adverse potentially irreversible impacts on soils, in accordance with NPS *Management Policies*.

NPS-77 specified objectives for each management zone for soil resources management. These management objectives are defined as: (1) natural zone - preserve natural soils and the processes of soil genesis in a condition undisturbed by humans; (2) cultural zone - conserve soil resources to the extent possible consistent with maintenance of the historic and cultural scene and prevent soil erosion wherever possible; (3) park development zone - ensure that developments and their management are consistent with soil limitations and soil conservation practices; and, (4) special use zone - minimize soil loss and disturbance caused by special use activities, and ensure that soils retain their productivity and potential for reclamation.

Zones within the recreation area have been designated in the Lake Mead NRA *General Management Plan*, which provides the overall guidance and management direction for Lake Mead NRA.

NPS *Management Policies* defines the general principles for managing biological resources as maintaining all native plants and animals as part of the natural ecosystem. When NPS management actions cause native vegetation to be removed, then the NPS will seek to ensure that such removals will not cause unacceptable impacts to native resource, natural process, or other park resources.

Non-native species, also referred to as non-native or alien, are not a natural component of the ecosystem. They are managed, up to and including eradication, under the criteria specified in *Management Policies* and NPS-77.

Impact Indicators, Criteria, and Methodology

Negligible: Impacts have no measurable or perceptible changes in soil structure and occur in a relatively small area. Impacts have no measurable or perceptible changes in plant community size, integrity, or continuity.

Minor: Impacts are measurable or perceptible but localized in a relatively small area. The overall soil structure would not be affected. Impacts are measurable or perceptible and localized within a relatively small area. The overall viability of the plant community would not be affected and, if left alone, would recover.

Moderate: Impacts would be localized and small in size, but would cause a permanent change in the soil structure in that particular area. Impacts would cause a change in the plant community (e.g. abundance, distribution, quantity, or quality); however, the impact would remain localized.

Major: Impact to the soil structure would be substantial, highly noticeable, and permanent. Impacts to the plant community would be substantial, highly noticeable, and permanent.

Impairment: For this analysis, impairment is considered a permanent change in a large portion of the overall acreage of the park, affecting the resource to the point that the park's purpose could not be fulfilled and the resource would be degraded precluding the enjoyment of future generations.

When these criteria were not applicable, and in the absence of quantitative data, best professional judgement prevailed.

Wildlife

Related Laws, Regulations, and Policies: The NPS *Organic Act*, which directs parks to conserve wildlife unimpaired for future generations, is interpreted by the NPS to mean native animal life should be protected and perpetuated as part of the recreation area's natural ecosystem. Natural processes are relied on to control populations of native species to the greatest extent possible. The restoration of native species is a high priority. Management goals for wildlife include maintaining components and processes of naturally evolving park ecosystems, including natural abundance, diversity and ecological integrity of plants and animals.

The recreation area manages and monitors wildlife cooperatively within the recreation area with the Arizona Game and Fish Department and the Nevada Department of Wildlife.

Impact Indicators, Criteria, and Methodology

The following are standards used by the NPS in interpreting the level of impact to wildlife:

Negligible impacts: No species of concern is present; no impacts or impacts with only temporary effects are expected.

Minor impacts: Nonbreeding animals of concern are present, but only in low numbers. Habitat is not critical for survival; other habitat is available nearby. Occasional flight responses by wildlife are expected, but without interference with feeding, reproduction or other activities necessary for survival.

Moderate impacts: Breeding animals of concern are present; animals are present during particularly vulnerable life-stages, such as migration or winter; mortality or interference with activities necessary for survival expected on an occasional basis, but not expected to threaten the continued existence of the species in the park.

Major impacts: Breeding animals are present in relatively high numbers, and/or wildlife is present during particularly vulnerable life stages. Habitat targeted by actions has a history of use by wildlife during critical periods, but there is suitable habitat for use nearby. Few incidents of mortality could occur, but the continued survival of the species is not at risk.

Impairment: The impact would contribute substantially to the deterioration of natural resources to the extent that the park's wildlife and habitat would no longer function as a natural system. Wildlife and its habitat would be affected over the long-term to the point that the park's purpose (Enabling Legislation, *General Management Plan*, *Strategic Plan*) could not be fulfilled and resource could not be experienced and enjoyed by future generations.

When these criteria were not applicable, standard definitions for degree of change related to existing conditions were used. In the absence of quantitative data, best professional judgement prevailed.

Threatened, Endangered and Sensitive Species

Related Laws, Regulations, and Policies: Section 7 of the *Endangered Species Act*, as amended, mandates all federal agencies to determine how to use their existing authorities to further the purposes of the Act to aid in recovering listed species, and to address existing and potential conservation issues. Section 7(a)(2) states that each federal agency shall, in consultation with the Secretary, insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat.

Management Policies directs the parks to survey for, protect, and strive to recover all species native to National Park System units that are listed under the *Endangered Species Act* (4.4.2.3). It sets the direction to meet the obligations of the Act. *Management Policies* also directs the NPS to inventory, monitor, and manage state and locally listed species, and other native species that are of special management concern to the parks, to maintain their natural distribution and abundance.

The *General Management Plan* designated zones within the recreation area, including natural areas with known habitat or potential habitat for rare, threatened, or endangered species were further protected by placement in the environmental protection or outstanding natural feature subzone of the natural zone. Management of these zones focuses on the maintenance of isolation and natural process, and restoration of natural resources.

Impact Indicators, Criteria, and Methodology

The *Endangered Species Act* defines the terminology used to assess impacts to listed species as follows:

No effect: The appropriate conclusion when the action agency determines that its proposed action would not affect a listed species or designated critical habitat.

Is not likely to adversely affect: The appropriate conclusion when effects on listed species are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species. Insignificant

effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur.

Based on the best judgement, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur.

Is likely to adversely affect: The appropriate finding if any adverse effect to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not: discountable, insignificant, or beneficial. In the effect the overall effect of the proposed action is beneficial to the listed species, but is also likely to cause some adverse effects, then the proposed action "is likely to adversely affect" the listed species. If incidental take is anticipated to occur as a result of the proposed action, an "is likely to adversely affect" determination should be made.

Is likely to jeopardize proposed species/adversely modify proposed critical habitat – (Impairment): The appropriate conclusion when the action agency or the U.S. Fish and Wildlife Service identify situations in which the proposed action is likely to jeopardize the continued existence of a proposed species or adversely modify the proposed critical habitat.

Air Quality and Visibility

Related Laws, Regulations, and Policies: Lake Mead NRA and Parashant NM are designated as a Class II Air Quality area under the *Clean Air Act*. The main purpose of this act is to protect and enhance the nation's air quality to promote the public health and welfare. The act establishes specific programs to provide protection for air resources and values, including the program to prevent significant deterioration of air quality in clean air regions of the country. Although Lake Mead NRA and Parashant NM are designated as a Class II Air Quality area, the park strives to maintain the highest air quality standards, and project work within the recreation area and national monument is completed in accordance with regional standards. However, the recreation area does not possess sufficient autonomous authority to address issues of air quality improvements when air pollution originates outside the boundaries. NPS *Management Policies* direct parks to seek to perpetuate the best possible air quality to preserve natural and cultural resources, sustain visitor enjoyment, human health, and preserve scenic vistas (4.7). Parks are directed to comply with all federal, state, and local air quality regulations and permitting requirements.

Impact Indicators, Criteria, and Methodology

The impact categories relevant to air quality issues were developed for the Lake Mead NRA *Lake Management Plan* and can be slightly modified for use in the fire management program. Each category is discussed below relative to potential airborne pollution impacts from the alternatives on park resources and human health.

Negligible impacts: There is no visible smoke. Ambient air quality concentrations are well below (less than 60%) of standards (National Ambient Air Quality Standards (NAAQS or EPA's Air Quality Index).

Minor impacts: Smoke is visible during brief periods of time. Dust from the use of dirt roads is visible during brief periods. Mitigation is able to alleviate the impacts. Ambient air quality concentrations are well below (less than 60%) of standards (NAAQS or EPA's Air Quality Index).

Moderate impacts: Smoke is visible during extended periods. Dust from the use of dirt roads is visible for an extended area. Mitigation is able to alleviate the impacts. Ambient air quality concentrations approach (between 60% and 100%) of standards (NAAQS or EPA's Air Quality Index).

Major impacts: Smoke is easily detectable for extended periods of time in a large area. Dust from the use of dirt roads and equipment is visible for an extended period for an extended amount of time, and mitigation is unable to alleviate the conditions. Ambient air quality concentrations equal or exceed the standards (NAAQS or EPA's Air Quality Index).

Impairment: Air emissions contribute to continued violation of national standards. In addition, impacts have a major effect on park resources and values; contribute to the deterioration to the extent that the park's purpose can not be fulfilled as established in its enabling legislation; affect resources key to the park's natural or cultural integrity or opportunities for enjoyment; or affect the resource whose conservation is identified as a goal in the park's general management plan or other park planning document.

Scenic Quality

Related Laws, Regulations, and Policies: The enabling legislation of Lake Mead NRA specifically addresses the preservation of the scenic features of the area. The proclamation for the Parashant NM specifically addresses the preservation of the scientific and historic objects. The NPS manages the natural resources of the park, including highly valued associated characteristics such as scenic views, to maintain them in an unimpaired condition for future generations (*Management Policies* 4).

Since impacts on scenic quality are difficult to assess, best professional judgement prevailed in the evaluation of impacts.

Water Resources

Related Laws, Regulations, and Policies: NPS policies require protection of water resources consistent with the *Clean Water Act*. Increased erosion following a fire event, planned or unplanned, may affect water quality within and outside of the recreation area; therefore, it is considered a relevant impact topic. Water supply, or the lack thereof, within the recreation area is also analyzed as an impact topic**.** Lakes Mead and Mohave supply water for wildlife, as do a number of small seeps and springs away from the lakes. Thus, the potential flood run-off and the availability of water to suppress a fire event are therefore analyzed.

Further guidance for the protection of water quality is included in *Management Policies* (4.6) which directs the NPS to work with appropriate government bodies to obtain the highest possible standards available under the *Clean Water Act* for the protection for park resources, and to take the necessary actions to maintain or restore the quality of surface and ground waters within the parks consistent with the *Clean Water Act* and all other applicable federal, state, and local laws and regulations.

Wetlands and Riparian Areas

Related Laws, Regulations, and Policies: Riparian areas are protected under the same guidelines as soils, vegetation, and wildlife. Wetlands are protected in accordance with standards set by the *Clean Water Act*, and NPS policies on wetlands management, including EO 11900 (Protection of Wetlands), and the *Fish and Wildlife Coordination Act of 1934*, PL 85-624, as amended (16 USC §§ 661 - 666c). NPS *Procedural Manual #77-1, Wetland Protection*, further clarifies the NPS policies related to the protection of wetlands.

Impact Indicators, Criteria, and Methodology

Negligible: Impacts have no measurable or perceptible changes and occur in a relatively small area. Impacts have no measurable or perceptible changes in riparian plant community size, integrity, or continuity.

Minor: Impacts are measurable or perceptible but localized in a relatively small area. The overall riparian area would not be affected. Impacts are measurable or perceptible and localized within a relatively small area. The overall viability of the riparian community would not be affected and, if left alone, would recover.

Moderate: Impacts would be localized and small in size, but would cause a permanent change in the riparian community in that particular area. Impacts would cause a change in the riparian plant community (e.g. abundance, distribution, quantity, or quality); however, the impact would remain localized.

Major: Impact to the riparian area would be substantial, highly noticeable, and permanent. Impacts to the riparian plant community would be substantial, highly noticeable, and permanent.

Impairment: For this analysis, impairment is considered a permanent change, affecting the resource to the point that the park's purpose could not be fulfilled and the resource would be degraded precluding the enjoyment of future generations.

When these criteria were not applicable, and in the absence of quantitative data, best professional judgement prevailed.

Visitor Use

Related Laws, Regulations, and Policies: Visitor use in parks is authorized in the NPS *Organic Act* and managed under the NPS *Management Policies* under Chapter 8, "Use of Parks" that includes commercial as well as public use. Recreational purposes and activities authorized at Lake Mead NRA are more specifically defined in Section 4 of the area's enabling legislation, Public Law 88-639.

Impact Indicators, Criteria, and Methodology

Negligible impacts: No impact to the visitor experience or only temporary effects are expected. Little noticeable change in visitor experience or in the defined indicators of visitor satisfaction or behavior.

Minor impacts: Desired visitor experience is changed, but without appreciably limiting or enhancing critical characteristics of the experience. Visitor satisfaction would remain stable.

Moderate impacts: Critical characteristics of the desired experience are changed or the number of participants engaging in an activity is altered. Visitor satisfaction would begin to decline.

Major impacts: Eliminates, detracts from, or greatly enhances multiple critical characteristics of the desired experience or greatly reduces or increases participation. Visitor satisfaction would decline substantially.

Socioeconomic Resources and Grazing

Related Laws, Regulations, and Policies: The enabling legislation of Lake Mead NRA permitted the Secretary to provide for grazing, "subject to such limitations, conditions, or regulations as he may prescribe, and to such extent as will not be inconsistent with either the recreational use of the primary use of that portions of the area heretofore withdrawn for reclamation purposes." NPS *Management Policies* states that livestock use, as specifically authorized by a park's enabling legislation, will be allowed only where it would not cause unacceptable impacts to a park's resources, values, or purposes (8.6.8). The *Parashant Interdisciplinary Management Plan* recognized that grazing could occur but would be managed to provide rest on the allotments due to fire and vegetation treatments.

Impact Indicators, Criteria, and Methodology

Negligible: No impacts to grazing would occur.

Minor: The impact to grazing is slight. Small portions of grazing allotments would be temporarily closed to grazing during treatment and restoration activities.

Moderate: The impact to grazing is readily apparent. Grazing allotments would be temporarily closed to grazing during treatment and restoration activities, or due to unsuitable conditions.

Major: The impact to grazing is severe. Grazing allotments would be closed for longer periods of time due to treatment and restoration activities, or due to unsuitable conditions.

When these criteria were not applicable, and in the absence of quantitative data, best professional judgement prevailed.

Cultural Resources

Related Laws, Regulations, and Policies:

Nearly all fire management projects qualify as undertakings as defined in 36 CFR §800.2,

> [A]ny project, activity, or program that can result in changes in the character or use of historic properties, if any such properties are located in the area of potential effects. The project, activity, or program must be under the direct or indirect jurisdiction of a Federal agency or licensed or assisted by a Federal agency.

Thus, each is subject to consideration under Section 106 of the *National Historic Preservation Act of 1966, as amended*. Recently, several attempts have been launched to develop programmatic approaches to prescribed fire compliance. Since 1999, the NPS, in conjunction with other DOI agencies and the USFS, has been developing a nationwide programmatic agreement between the national and state offices of historic preservation and the Advisory Council on Historic Preservation (ACHP) (Gleeson and Jones 2000). Completion of this document, which is intended to be augmented with specific compliance needs of a particular unit, resource area or forest, has been delayed due to the complexity and diversity of fire programs throughout the United States.

Numerous legislative acts, regulations, and NPS policies provide direction for the protection, preservation, and management of cultural resources on public lands. Further, these laws and policies establish what must be considered in general management planning and how cultural resources must be managed in future undertakings resulting from the approved plan regardless of the final Alternative chosen. Applicable laws and regulations include the NPS *Organic Act* (1916), the *Antiquities Act of 1906*, the *National Historic Preservation Act of 1966* (1992, as amended), the *National Environmental Policy Act* (1969), the *National Parks and Recreation Act of 1978*, the *Archeological Resources Protection Act of 1979*, the *Native American Graves Protection and Repatriation Act of 1990*, and the *Curation of Federally Owned and Administered Archeological Collections* (1991).

Consultation with Native American groups is required under Executive Memorandum of April 29, 1994, Government to Government Relations with Native American Tribal Governments; Executive Order 13007 of May 24, 1996, Indian Sacred Sites; and, Executive Order of May 14, 1998, Consultation and Coordination with Indian Tribal Governments.

Applicable agency policies relevant to cultural resources include Chapter 5 of NPS *Management Policies*, and the *Cultural Resource Management Guideline* (DO-28), as well as other related

policy directives such as the NPS *Museum Handbook*, the NPS *Manual for Museums*, and *Interpretation and Visitor Services Guidelines* (NPS-26).

NPS Management Guidelines (2001) Section 5.3.1.2: Fire Detection, Suppression, and Post-fire Rehabilitation and Protection states that the NPS will take action to prevent or minimize the impact of wildland, prescribed, and structural fires on cultural resources, including the impact of suppression and rehabilitation activities. Park and local fire personnel will be advised of the locations and characteristics of cultural resources threatened by fire, and of any priorities for protecting them during any planned or unplanned fire incident. At parks with cultural resources, park fire personnel will receive cultural resource protection training. At parks that have wildland or structural fire programs, cultural resource management specialists will receive fire prevention and suppression training and, when appropriate, will be certified for incident management positions commensurate with their individual qualifications.

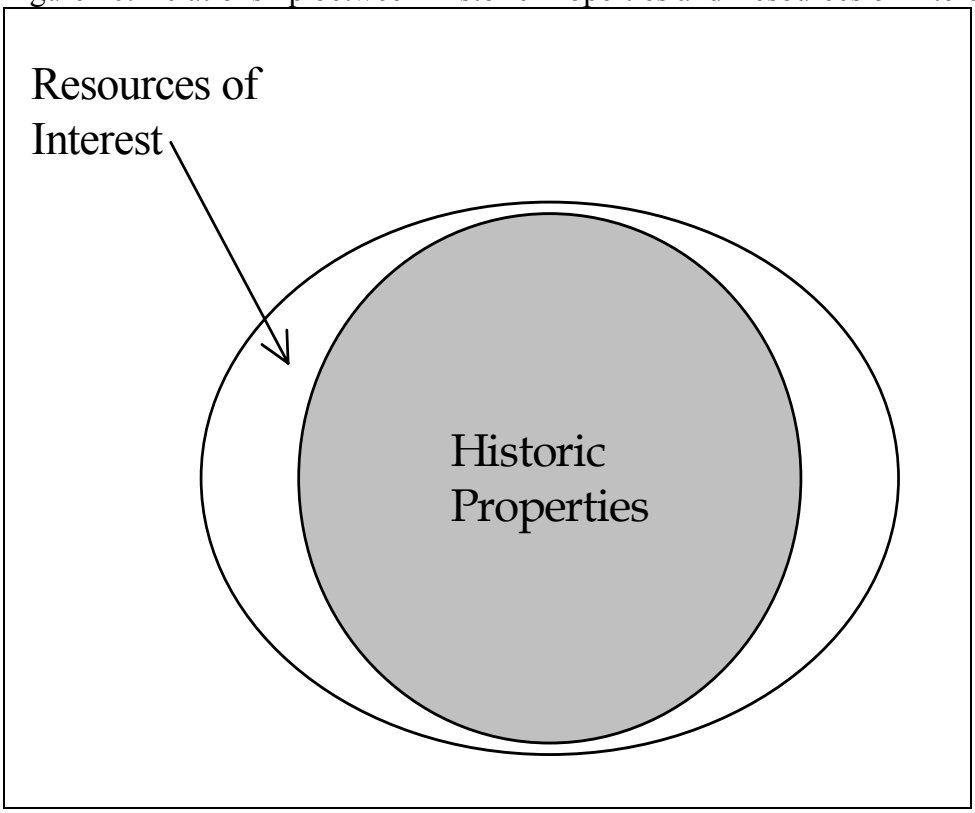
Impact Indicators, Criteria, and Methodology

Terms found in Section 106 of the National Historic Preservation Act are used to describe cultural resource significance and effects in this section. However, it is important to distinguish Historic Properties (as defined in the National Historic Preservation Act) from *resources of interest*, which are those classes of resources that have some potential to be important, and have the potential to be impaired by the fire management action. While Historic Properties are *de facto* resources of interest, these might also include sites, features, structures or other phenomenon that do not meet National Register of Historic Places criteria of significance, the minimum age requirement, and/or possesses sufficient integrity, but contribute somehow to our understanding of prehistory, history, or traditional lifeways, and could be compromised (Figure 20). Each resource of interest is comprised of a set of attributes, called significant characteristics, which lend importance to that resource.

An example of a resource of interest at Lake Mead NRA are small, sparse flaked stone lithic scatters. Such resources typically have low data potential and diminished integrity due to historic land-use practices, and would generally not qualify as Historic Properties. However, when one considers that much of the prehistoric archeological record found at Lake Mead NRA was heavily impacted by the construction of the reservoir, and the rapid rate of urbanization on surrounding lands, small, sparse flaked stone lithic scatters command greater importance as sources of information for understanding Native American lifeways along the Colorado River and adjacent uplands. As such, these sites deserve consideration when threatened by impacts from fire management actions and, unless deserving otherwise (e.g., modern trash scatters), all cultural resources will be considered resources of interest.

The National Environmental Policy Act (NEPA) recognizes three types of impacts—direct, indirect, and cumulative. Direct impacts are those that are caused at the same time and place as the action, indirect impacts occur later in time and at a distance, while cumulative impacts are additive. In regard to cultural resources, direct, operational and indirect effect categories are utilized. Direct effects are those where the fire itself is the cause of the impacts, operational effects occur as a result of associated operations like line construction or staging. Indirect effects

Figure 20. Relationship between Historic Properties and Resources of Interest.



are those where fire and/or associated operations result in changes to local context such that cultural resources will be affected. As such, direct and operational effects for cultural resources are the equivalent of direct impacts under NEPA, while indirect effects on cultural resources correspond to indirect and cumulative impacts. Effects also vary in terms of intensity and duration, and can be adverse or beneficial.

One major impediment to cultural resources compliance related to fire management actions is a poor understanding of the nature of direct, operational and indirect effects. In an effort to remedy this situation, Federal agencies sponsored the preparation of a volume of fire effects on cultural resources to be published through the U.S. Forest Service "Rainbow Series" on fire effects. This document has yet to appear, so a review of existing fire effects knowledge was prepared and is presented in Appendix H. The appendix broadly summarizes known direct fire effects on those components that comprise the cultural resources of Lake Mead NRA (e.g., stone, bone, glass, metal, wood), and operational and indirect effects that could potentially occur as a result of the proposed fire management actions.

Direct Effects

Cultural resources vary in terms of their susceptibility to direct fire effects. Predicting whether a particular cultural resource or its attributes will be impacted by a given fire event, however, is difficult. First, relatively few controlled studies have been performed to determine the impacts of fire on cultural materials. Second, the results from many of these are ambiguous or even

contradictory, and underscore the complexity of this topic. Third, most studies of direct fire effects tracked fire temperature in relation to resource condition. However, predictions of fire intensity generated from computer models such as "BEHAVE" are typically provided in, along with flame length, British Thermal Units (BTUs). These units of measurement are not easily compared, so it can be difficult to infer whether a given fire event will meet or exceed the temperature threshold of a given resource of interest.

Still, a general evaluation of direct effects can be made based on temperature data gathered from fuel models represented at Lake Mead NRA, anticipated fire intensities at Lake Mead NRA, generic fire temperature data, and the differential vulnerability of cultural materials to direct fire effects. Fire temperature and intensity data for fuels models at Lake Mead NRA are summarized in Table 6. It is important to note that fire temperature data almost certainly fail to capture the upper limits of temperature ranges for each fuel model.

Table 6. Lake Mead NRA Fuel Model Fire Temperature and Intensity Data

Fuel Model	Fuels	Temperature Range (C°)[1]	Normal Intensity Fire (BTU/ft./sec.)	Normal Flame Length (m.)	Extreme Intensity Fire (BTU/ft./sec.)	Extreme Flame Length (m.)
FMU-1						
1	Creosote/ Bursage	23-878[2]	504	7.9	1415	12.7
4	Tamarisk	0-1000[3]	3629	19.5	22908	45.6
FMU-2						
1	Creosote/ Bursage	23-878[2]	504	7.9	1415	12.7
8	Pinyon/ Juniper/ Oak/Shrub	0-1000[3]	9	1.2	45	2.6
4	Tamarisk	0-1000[3]	3629	19.5	22908	45.6
FMU-3						
2	Sagebrush	0-1000[3]	1256	12	7433	27.2
8	Pinyon-Juniper	0-1000[3]	9	1.2	45	2.6
9	Ponderosa Pine	0-1000[3]	79	3.4	502	7.9

1 Temperature at soil surface unless otherwise noted

2 Data from Brooks (2002) and T. Esque, Unpublished Data.

3 Estimated temperature range, research in progress. Fire intensity and flame length data was recorded by Behave calculations from parameters of Lake Mead National Recreation Area prescribed fire burn plans

Fire duration is also an important factor in determining potential direct effects; generally speaking, the longer the residence time, the higher the likelihood for impacts. Fire duration (rate of spread) data for the fuel models at Lake Mead NRA are presented in Table 7 as the time (in minutes) for a fire to spread across an area 100 m. in diameter (a hypothetical archeological site) under normal and extreme conditions. Based on these quantitative data, fire temperature/intensity and rate of spread were placed into ordinal categories (low, moderate, and high) and assigned to each fuel model (Table 8). Refinements to these measures will be made as more data are obtained, including allowances for variation in fuel load, slope, aspect and other variables.

Table 7. Lake Mead NRA Fuel Model Rate of Fire Spread Data

Fuel Model	**Fuels**	**Normal Rate of Spread (minutes)[1]**	**Extreme Rate of Spread (minutes)[1]**
FMU-1			
1	Creosote/ Bursage	12.5	0.6
4 & 6	Tamarisk	20	1
FMU-2			
1	Creosote/ Bursage	12.5	0.6
4	Pinyon/Juniper/ Oak/Shrub	10	2.2
4 & 6	Tamarisk	20	1
FMU-3			
2	Pinyon-Juniper	25	1.9
2	Sagebrush	25	1.9
6	Pinyon-Juniper	20	1
9	Ponderosa Pine	100	2.3

1 Rate of spread across area 100 m. in diameter

Table 8. Lake Mead NRA Fuel Model Fire Temperature/Intensity and Rate of Spread Data Summary

Fuel Model	Fuels	Normal Conditions		Extreme Conditions	
		Temp/ Intensity	Rate of Spread	Temp/ Intensity	Rate of Spread
FMU-1					
1	Creosote/Bursage	Low	Moderate	Moderate	High
4 & 6	Tamarisk	High	Low	High	Moderate
FMU-2					
1	Creosote/Bursage	Low	Moderate	Moderate	High
4	Pinyon/Juniper/ Oak/Shrub	High	Moderate	High	High
4 & 6	Tamarisk	High	Low	High	Moderate
FMU-3					

2	Pinyon-Juniper	Low	Low	Moderate	High
2	Sagebrush	Low	Low	Moderate	High
6	Pinyon-Juniper	Moderate	Low	High	Moderate
9	Ponderosa Pine	Low	Low	Moderate	Low

Based on data summarized in Appendix H, Table 9 lists those resources of interest with high vulnerability to direct fire effects. Although fires in Fuel Model 1 can reach moderate temperatures, low residence time probably keeps impacts to a minimum on all but the most sensitive resources. A larger number of resources of interest are probably threatened in Fuel Model 2 due to increased residence time. Finally, the rest of the fuel models tend to support slow moving and/or high intensity fires that can damage even the most durable resources of interest.

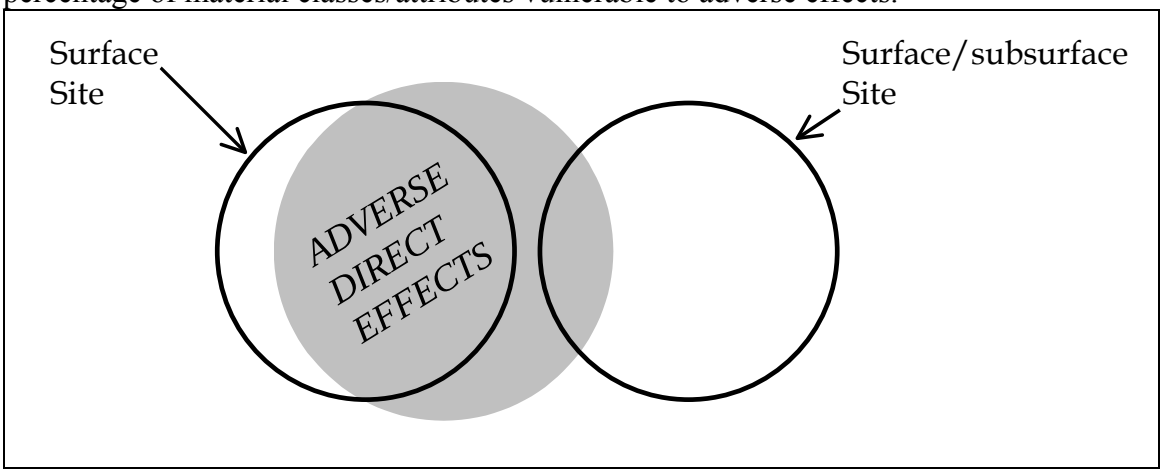
Table 9. Cultural Materials/Attributes at Lake Mead NRA with High Vulnerability to Direct Fire Effects by Fuel Model

Fuel Model	**Cultural Material/Attribute**
All Models	Wooden features and artifacts
	Vegetation
	Obsidian hydration rinds
	Chert artifacts
	Rock imagery
	Fiber and hides
	Rubber and plastic artifacts
	Packrat middens
2	Native American ceramics
	Bone
	Shell
	Organic residues
4, 4 & 6, 6, 9	Native American ceramics
	Bone
	Shell
	Organic residues
	Groundstone
	Midden soil
	Metal artifacts and features
	Glass artifacts
	Historical ceramics
	Cement, brick and cinderblock

As emphasized in Appendix H, direct effects are far more likely to occur in resources of interest located on or above the ground surface. Some resources of interest are found almost exclusively above the ground surface (e.g., rock imagery sites), others exclusively below the ground surface (e.g., buried archeological sites), and still others include a combination of surface and subsurface elements. All else being equal, those resources comprised of only surface materials have a

greater percentage of their number adversely impacted by direct fire effects than those resources with a combination of surface and subsurface material. This is significant because cultural resources generally considered to have high data potential, such as Native American villages with subsurface components, may actually have a far lower percentage of artifact classes or attributes exposed to direct fire effects than a lithic scatter, often considered to have low data potential that is restricted to the ground surface (Figure 21). While it is the village that would probably receive the greatest amount of attention in regard to a planned or unplanned fire management action, it is the lithic scatter that has the potential to undergo the greatest intensity of impact.

Figure 21. Susceptibility of cultural materials in surface and surface/subsurface contexts to direct fire effects. Open circles reflect the full range of artifact classes/attributes represented at each site type, and the amount of overlap with the shaded circle represents the amount or percentage of material classes/attributes vulnerable to adverse effects.



Determining if and/or to what extent a resource of interest has subsurface components is best accomplished through invasive (e.g., excavation, auguring) or non-invasive (e.g., remote sensing, cut bank inspection) means. As discussed in Chapter 3, relatively few of these studies have been carried out at Lake Mead NRA. While people do intentionally and unintentionally bury cultural materials (e.g., trash dumps, burials), it is geomorphological processes that dictate whether a given resource of interest is likely to have a subsurface component. In general, toeslopes, footslopes, and terraces will have greater accumulations of colluvium and alluvium than summits and sideslopes, from which these sediments are eroding. In the absence of invasive or non-invasive investigations, inferences about the presence and extent of subsurface components can be drawn based on the geomorphological context in which a resource is found. As such, an archeological site located on a ridge top may be more vulnerable to direct effects than one with the same fuel load located on a colluvium-covered toeslope.

Ideally, fire history data can be used to predict previous fire-related impacts to resources of interest. In areas that have burned once or more, the potential exists that resources of interest found there were already subjected to adverse impacts. However, it is important to consider several factors regarding past fires. First, at least during the precontact and early historic periods, widespread fire was probably only common in the Shivwits Plateau (FMU-3) portion of Lake Mead NRA. Second, most fires tend to burn in a mosiac pattern, so a resource of interest

located within the perimeter of a past burn may not have been exposed to flame or heat. Second, prior to intensive fire suppression, fuel loads were probably lower and fire intensity less severe. Cooler fires may have meant that the damage thresholds of cultural materials were less frequently met or exceeded. Third, cultural material can be moved by post-depositional disturbances such as rodent burrowing and erosion, so artifacts observed on the ground surface may have been buried during the past and previous fire events. Finally, as discussed in Appendix H, burned cultural materials may provide valuable information on land-use history. As fire history data for Lake Mead NRA become more readily available, these will be used to help assess past direct impacts on resources of interest.

Operational Effects

Operational effects relate to the impacts from fireline construction, staging, mop-up and rehabilitation, and looting. Such disturbances are likely to occur during wildland fire activities or suppression zones in areas that have not been inventoried for cultural resources or without input from a qualified Cultural Resource Specialist.

Indirect Effects

Indirect effects are those where fire and/or associated operations result in changes to local context such that cultural resources will be affected. This includes impacts from erosion, increased tree mortality, carbon contamination and looting.

Beneficial Impacts

Beneficial impacts to fire management actions will also be evaluated in the environmental consequences section. Beneficial impacts relate to the application of fire and mechanical treatments to reduce threats from catastrophic wildfire to archeological sites, historic structures, and cultural landscapes. Ethnographic resources can also benefit from the use of fire management practices.

Intensity and Duration of Impacts

It is also necessary to take into the account the intensity and duration of direct, operational and indirect effects to resources of interest. The following measures of impact intensity are used, along with examples of resources of interest most vulnerable to those impacts and/or scenarios where a particular intensity of impact might occur:

Negligible: No or barely perceptible and changes to the significant characteristics of a resource of interest.

Minor: Perceptible and measurable changes to the significant characteristics of a resource of interest, but those changes do not inhibit interpretive potential and/or a minor percentage of the significant characteristics will be affected.

Impact	**Example(s)**
Direct	▪ Resources of interest containing a high percentage of attributes with low vulnerability to direct effects (e.g., can dump), possessing subsurface components, and/or found in Fuel Model 1.
Operational	▪ Resources of interest subjected to minimal ground disturbance (e.g., hand tools) and/or possessing subsurface components. ▪ Resources of interest having few or no readily identifiable artifacts or features above or near the ground surface (e.g., lithic quarries).
Indirect	▪ Resources of interest located on unstable landforms subjected to low intensity fires. ▪ Surface archeological sites with fire-killed trees located near, but not on site.

Moderate: Perceptible and measurable changes to the significant characteristics of a resource of interest, but those changes do not inhibit interpretive potential and/or a moderate percentage of the significant characteristics will be affected. Resources prone to impacts in this category might include archeological sites containing a moderate percentage of resources of interest with low vulnerability to direct effects and/or possessing subsurface components.

Impact	**Example(s)**
Direct	▪ Resources of interest containing a moderate percentage of attributes with low vulnerability to direct effects (e.g., historic mine containing can dumps, concrete foundations, collapsed wooden structures, and historic vegetation), possessing subsurface components, and/or found in Fuel Models 2 and 9.
Operational	▪ Resources of interest subjected to moderate ground disturbance (e.g., hand tools and/or some heavy equipment) and/or possessing subsurface components. ▪ Resources of interest having moderate numbers of readily identifiable artifacts or features above or near the ground surface (e.g., Native American ceramic scatters, small rock imagery sites).
Indirect	▪ Resources of interest located on unstable landforms subjected to moderate intensity fires ▪ Surface/subsurface archeological sites with fire-killed trees located near, but not on site.

Major: Perceptible changes to the significant characteristics of a resource of interest, and those changes inhibit interpretive potential of a major percentage of the significant characteristics. Resources prone to impacts in this category might include archeological sites containing a large percentage of resources of interest with high vulnerability to direct effects.

Impact	**Example(s)**
Direct	▪ Resources of interest containing a high percentage of attributes with low vulnerability to direct effects (e.g., historic ranch complex with structures, corrals, fences, vegetation, etc.), lacking subsurface components, and/or found in Fuel Models 4, 4 & 6, and 6.
Operational	▪ Resources of interest subjected to significant ground disturbance (e.g., extensive heavy equipment) and/or lacking subsurface components. ▪ Resources of interest having large numbers of readily identifiable artifacts or features above or near the ground surface (e.g., Native American village sites).
Indirect	▪ Resources of interest located on unstable landforms subjected to high intensity fires. ▪ Surface/subsurface archeological sites with fire-killed trees located on site.

The duration of direct effect impacts are defined as follows:

Short-Term: Temporary loss of data potential in the significant characteristics of a resource of interest. This condition is reversible within a foreseeable timeframe (e.g., loss of significant grass and shrub vegetation in a cultural landscape).

Long-Term: Temporary loss of data potential in the significant characteristics of a resource of interest. This condition is reversible, but after an uncertain or excessively long period of time (e.g., sooting on Native American ceramics or other artifacts).

Permanent: Permanent loss of data potential in the significant characteristics of a resource of interest. Permanent direct effects usually occur immediately following the fire event (e.g., total consumption of a wooden feature).

Park Operations, Public Health, and Safety

Related Laws, Regulations, and Policies: *The Federal Wildland Fire Management Policy and Program Review,* 1995, provides fire policies related to safety. The guiding principles are fundamental and establish firefighter and public safety as the first priority in every fire management activity. Public safety and the safety of all personnel engaged in a fire event is the primary concern of park managers.

Impact Indicators, Criteria, and Methodology

Negligible Impacts: The impact to personnel and visitor safety is not measurable or perceptible.

Minor Impacts: The impact to personnel and visitor safety is slight and temporary, but not sufficient to cause a permanent change in accident rates and can be immediately controlled by management actions in a timely manner.

Moderate Impacts: The impact to personnel and visitor is slight and temporary, but could create

a slight permanent increase in accident rates. The safety of park personnel and visitors can not be controlled immediately by park management, but control would occur within 24 hours.

Major Impacts: The impact to personnel and visitor safety is sufficient to cause a permanent change in accident rates at existing low accident locations.

Wilderness and Land use (Designated, suitable and potential wilderness, adjacent land use, permitted right-of-ways)

Related Laws, Regulations, and Policies: The *Wilderness Act* (P.L. 88-577) established a national Wilderness Preservation System to ensure that federally owned areas designated by Congress as wilderness could be managed for the enjoyment and use for all Americans in a manner that will leave them unimpaired for future generations. *Resource Management Guidelines* (NPS-77), the 1999 NPS Directors Order 41 (DO-41), *Wilderness Preservation and Management*, and NPS *Management Policies* specifically state that the term wilderness includes the categories of *designated, proposed, potential, recommended, study areas,* and *suitable*, and that wilderness policies apply in these areas regardless of the category. Lake Mead NRA has designated wilderness areas, proposed and proposed potential wilderness, and these areas are managed to preserve the character of the wilderness resource.

Impact Indicators, Criteria, and Methodology

Negligible: There would be no measurable change, and the wilderness character of the area would not be altered. The impact is at the lower level of detection.

Minor: The impact is slight, but detectable during only a short duration; a small change would occur but it would not alter the wilderness character of the area.

Moderate: The impact is readily apparent; a measurable change would occur and could result in a small but temporary change to the wilderness character. The change would be longer in duration than a minor impact, but still considered a temporary change.

Major: The impact is severe; a permanent measurable change would occur to the portions of the wilderness area. The wilderness character of impacted areas could be altered in a large area for an extended period of time.

Impairment: The impact would harm the entire integrity of the wilderness resource, and permanently alter the wilderness character, making the area unsuitable for wilderness designation.

When these criteria were not applicable, and in the absence of quantitative data, best professional judgement prevailed.

CUMULATIVE IMPACTS

Cumulative impacts were analyzed for the alternatives and the environmentally preferred alternative. Cumulative impacts are the incremental impacts on the environment resulting from adding the alternatives to other past, present, and reasonably foreseeable future actions. This includes potential actions within and outside the recreation area boundary.

Specific projects with the potential to cumulatively affect the resources (impact topics) include fire management and vegetation treatment activities occurring adjacent to the recreation area boundary, area development and growth within and adjacent to the recreation area, and threatened and endangered species protection initiatives and programs.

Vegetative treatment and fire management activities have been ongoing adjacent to the recreation area in the Shivwits region. The BLM has established a proactive program in the Mt. Trumbull area to restore the ponderosa pine ecosystem. In addition, the BLM conducts burns and vegetative treatment elsewhere nearby in an attempt to restore the natural communities and processes in the region.

The populations of Las Vegas, Henderson, Laughlin, and Bullhead City have grown exponentially in the past 10 years. Several communities are developing up to recreation area boundaries. Housing developments and golf courses have been constructed adjacent to the recreation area boundary, and it is anticipated that this trend will continue to increase. With development and growth there is ground disturbance and planting and potential spread of non-native and highly invasive vegetation. This development is occurring adjacent to the low desert regions of the recreation area.

Non-native vegetation is spreading into the low desert regions of the recreation area. Non-native vegetation, such as grasses, could promote the spread of wildfires within the lower desert portions of the recreation area, changing the natural processes in these areas. The continuing spread and control of non-native vegetation is also a consideration on the Shivwits Region of the recreation area. The control and potential spread of non-native vegetation is considered in the evaluation of the cumulative impacts.

The establishment of Grand Canyon-Parashant NM, on the Shivwits Plateau portion of Lake Mead NRA, has led to increased visitation in that area. With increased use comes the potential for more wildfires, from escaped campfires and other human activities. This has been considered in the analysis.

The Clark County Multiple Species Habitat Conservation Plan was completed in 2000 and identified protection measures for sensitive, threatened, and endangered plant and animal species in southern Nevada. Several more planning initiatives for the protection of these species are in development.

This information was considered when developing the cumulative impacts of each alternative. However, this information may be inexact at this time. Major sources of impacts have been assessed as accurately and completely as possible, using all available data. If additional data

becomes available, more detailed analysis would be performed during the completion of individual prescribed fire plans for each site.

ENVIRONMENTAL CONSEQUENCES

The environmental consequences section is organized by impact topic to better clarify the different impacts under each alternative. The following is a summary of each alternative, followed by the environmental consequences under the associated resource impact topic.

ALTERNATIVE A: NO ACTION - CONTINUE CURRENT MANAGEMENT

This alternative is based on suppression, wildland fire use, prescribed fire, and mechanical hazard fuel reduction. Two fire management units, suppression and wildland fire use, are designated within the recreation area. In general, the suppression units are located below an elevation of 6,000 feet in the lower desert portions of the recreation area. The wildland fire use units are located on the Shivwits Plateau, except in areas where suppression zones were determined appropriate due to management concerns. This alternative does not designate interface zones nor does it formalize a fuels management program in the lower desert portion of the recreation area. It does include the ongoing vegetation treatment program utilizing prescribed fire and mechanical hazard fuel reduction on the Shivwits Plateau, as described in Appendix A. It also supports the continuation of the tamarisk eradication program in riparian areas within the recreation area, utilizing herbicide treatment and prescribed fire.

ALTERNATIVE B – FULL SUPPRESSION PROGRAM

Suppression activities in the low desert region of the recreation would result in the same impacts as the impacts from suppression activities analyzed in *Impacts from Alternative A.* This alternative is different in that it proposes a full suppression program on the entire region of the Shivwits Plateau. The full suppression program will be the focus of this evaluation. The tamarisk control program would continue within the riparian communities of the recreation area.

ALTERNATIVE C: COMBINATION OF WILDLAND FIRE USE AND SUPPRESSION (Environmentally Preferred and Management Preferred Alternative)

This alternative is similar to Alternative A and would result in similar impacts related to suppression activities in the low desert region, and wildland fire use on the Shivwits Plateau. The difference is that this alternative would establish three management units, including the Desert Unit (full suppression), Shivwits Unit (Wildland Fire Use), and the Interface Unit, where hazard fuel reduction activities would occur. This alternative does include the ongoing vegetation treatment program utilizing prescribed fire and mechanical hazard fuel reduction, and non-native plant control (tamarisk) utilizing prescribed fire followed by herbicide treatment. The evaluation of this alternative will include an analysis of the impacts associated with the interface unit and the fuels management program in the lower desert region of the recreation area.

VEGETATION AND SOILS

Impacts from Alternative A: Continue Current Management

Impacts Association with Suppression Activities: The impacts associated with suppression activities include impacts related to fire crews, vehicle use, construction of firelines, use of tools and equipment, and use of aerial support.

A minor amount of desert vegetation would be damaged from the construction of firelines for suppression activities. Generally in the low desert areas of Lake Mead NRA, constructed firelines are not utilized, existing roads and natural barriers are used to contain the fire. Additional acres may be burned out to achieve suppression objectives but these acres are fewer that would likely burn given no suppression actions.. When firelines are constructed in the desert, they are "scratch lines" between 6 and 12 inches wide. These scratch lines are constructed by hand crews using hand tools. Trampling and damage to desert vegetation could occur. Vehicles would not be permitted to travel off approved road, unless the unlikely emergency situation occurs where the fire is threatening important park resources, nearby communities or developed areas, or human life. Then vehicular access may be granted with superintendent's approval. Incident Commanders are granted blanket approval to use vehicles off road to protect human life. More damage to vegetation would occur in these rare situations, resulting in moderate impacts to vegetation. The impact to desert vegetation and soils from the construction of firelines is considered negligible to minor because they would be temporary impacts on a localized basis and not affect the overall viability of the plant community. If left alone, these scratch lines should recover.

The use of chemical retardant could damage vegetation and wildlife resources. Chemical retardant would not be utilized within 300 feet of spring resources or riparian areas.

Overall, desert vegetation would be protected from burning. On the rare occurrence when a fire in the low desert could not be contained, and grasses allow the fire to spread, larger acreages could be burned if suppression activities fail. This could promote the spread of non-native plants, such as red brome, in the burn area, and could change the overall vegetative composition and structure. This could result in moderate impacts since the likelihood of this occurring is low in most areas of the recreation area. In the past ten years, only one wildfire has burned large acreages (over 1,000 acres) in the lower desert portion of the recreation area. This wildfire occurred in the Newberry Mountains, in the southern portion of the recreation area, where grasses promoted its spread. The wildfire was partially contained, and eventually reached rock formations that prevented its spread. Park biologists have observed that, after an initial invasion by non-native red brome, that the burned area has recovered and native plants are reestablishing themselves in the area.

Firelines would also be constructed around suppression zones in the wildland fire use zones. This would occur on the Shivwits region of the recreation area. The construction of firelines on the Shivwits typically involves clearing vegetation in a 2 to 3 feet wide swath using hand crews with hand tools. When determined necessary and appropriate, leafblowers and chainsaws are also used to construct firelines. The firelines would be located around administrative structures,

historical and cultural sites, nesting sites, and other management designated sites. They would be maintained to protect these areas. Still, the overall impact to the vegetative community and the soils would be minor as the overall viability of the plant community would not be affected and the overall soil structure would not be affected.

Trampling and ground disturbance from suppression activities could adversely impact vegetation and soils, however impacts would be localized to high-traffic areas and would be considered minor.

Impacts Associated with Wildland Fire Use: A wildland fire use policy would remain in place on the Shivwits portion of the recreation area. The impacts associated with wildland fire use include impacts from the fire, the potential for the spread of non-native vegetation, use of monitoring crews and vehicles, and the construction of firelines to protect specific resources and administrative sites.

Vegetation would be burned during wildland fire use activities on the Shivwits Region of the recreation area. In optimum burn conditions, vegetation, including grasses, sagebrush, pinyon, juniper, and ponderosa pine would burn and could create uneven-aged stands. Grasses and forbs would dominate sites after a burn. Non-native species, such as cheat grass, could move into areas after burns. Mitigation would help prevent the spread of non-native and invasive species. In optimum situations, grasses and forbs would be followed by the re-establishment of shrubs followed by pinyon-juniper woodlands. The successional process would take decades, and the progression of seral stages and the occurrence of natural fires would provide a mosaic of vegetation.

Great Basin desert vegetation communities would benefit from the burning because it would restore the major natural cause of disturbance in these sagebrush scrub and pinyon-juniper woodlands. Wildland fires could reduce ground litter, and allow a natural thinning process. A result of the thinning process is the reestablishment of grasses and forbs, and allowing understory growth. Biodiversity in vegetative communities could improve, mosaic type vegetative communities could develop, and the overall health of the ecosystem could improve. This is considered a beneficial impact.

Low intensity fires would result in benefits to soils as fires generally return nutrients and organic matter to the soil in the form of ash. Soils would be disturbed if heavy equipment is used in the construction of firelines. The likelihood that heavy equipment would be authorized is very low and would be restricted to those areas with road access. However, if heavy equipment is authorized, erosion could occur from the use of heavy equipment, depending upon slope and soil type. This could create moderate to major impacts to the soils.

The reduction of forest floor litter and preventing excessive buildup of hazardous fuels could prevent a large, difficult to manage wildland fire from occurring. This would protect the vegetation and soils from a high intensity wildfire, which has been shown to damage the soils by sterilization. In addition, the heat from a high intensity fire could kill the vegetation on portions of the Shivwits Plateau.

Fires could result in some soil erosion and run-off, depending on amount of vegetation burned, soil, slope, and fire frequency. In the unlikely event that a high intensity fire occurs, this could result in pockets of soil sterilization that could take several years to recover. High intensity fires could occur in juniper areas and ponderosa areas that burn out of prescription. Most impacts to soils would be short-term. In past prescribed burns, grasses and forbs have reestablished in the most burn areas and have provided ground cover, decreasing erosion.

Fires would be monitored using aircraft, or by sending small fire crews to the site. Vehicles would be restricted to existing roads, and crews would have to access the fires by foot. Therefore, the impacts associated with using fire crews, including trampling, would be negligible.

Firelines would be constructed around sensitive resources, administrative sites, and identified cultural resources to prevent damage from wildland fires. Firelines would be maintained over the long-term to prevent potential spread of fire to these areas. This would prevent vegetation from growing in these areas. However, the firelines are small, 2 to 3 feet wide, and would only be constructed where necessary. Therefore, the impact to vegetation and soils from firelines is considered minor as the overall viability of the plant community would not be affected.

Impacts associated with Non-Native Plant Control in Riparian Areas: The use of prescribed fire to eliminate non-native tamarisk and other non-native vegetation at riparian and spring areas in Lake Mead NRA has allowed the reestablishment of native vegetation to more than 20 springs within the recreation area (Deuser pers. comm.). Prescribed burns are followed up by herbicide application using the low-volume basal spray method to the tamarisk resprouts within one year. Garlon 4 herbicide is used with this treatment method because it is selective to tamarisk only and is applied by highly- trained professional crews. Previous treatments and monitoring has shown that surrounding native vegetation is not negatively impacted by these treatments (Deuser pers.comm.). Garlon herbicide is not soil active and breaks down within a few weeks allowing for native plants to re-establish within a few months following treatment. Prescribed burning combined with herbicide treatments also includes site monitoring and active revegetation with native plants is applied if necessary. Monitoring by NPS biologists has shown that this method is beneficial to the riparian communities of the recreation area, improving the quality of the habitat, and reducing the potential for the reestablishment of non-native tamarisk. Ten-year post treatment monitoring data has shown that native plants continue to dominate the sites. In addition, tamarisk exudes salts from its leaves which increases surface soil salinity inhibiting desirable plants from establishing. Burning the salt filled tamarisk litter and duff layer removes the source of salt, eventually improving soil conditions and allowing for desirable plant establishment.

Cumulative Impacts

Allowing wildland fires to burn under specific prescriptions on the Shivwits Plateau could result in an improved vegetative community. However, the use of wildland fire alone has not shown to improve the overall conditions in the area. The occurrence of large wildland fires on the Shivwits is rare. Usually fires are naturally contained to one area due to lack of grasses or terrain, and do not spread into large fires. The continued use of a variety of vegetative treatment options on NPS and BLM administered lands, including prescribed burn and restoration thinning, would be necessary to achieve stated objectives. Cumulatively, the health of the ecosystem would continue to improve as a result of the treatment activities and the wildland fire use policy on both NPS and BLM administered lands in and adjacent to the Shivwits Region.

Conclusion

There would be minor impacts in the lower desert unit to vegetation due to the construction of firelines. If wildland fires occur under the wildland fire use program on the Shivwits Plateau unit, vegetation would burn, and it could eventually result in an improved, more diverse vegetative community. There is the potential for non-native species to establish after a burn, which could alter the vegetative community of the area, and create moderate adverse impacts. The use of prescribed fire and herbicide treatment to eliminate non-native vegetation in springs and riparian areas would benefit native vegetation, soils, and habitat in those areas. There would be no impairment to vegetation and soils as a result of the impacts associated with this alternative.

Impacts from Alternative B: Full Suppression

The impacts associated with suppression activities in the lower desert would be the same as described under Alternative A: Impacts associated with suppression activities. This alternative would have further impacts associated with removing fire from the natural process on the Shivwits Plateau.

The exclusion of fire as an ecosystem process would prevent a major natural cause of disturbance in the sagebrush scrub and pinyon-juniper woodlands of the Shivwits Plateau. Past suppression and other human-caused disturbance has led to a monoculture community of sagebrush and pinyon-juniper in large portions of the Shivwits Plateau, with limited amounts of grasses and forbs, which has led to a decrease in diversity. This has created moderate adverse impacts to the natural community of the Shivwits Plateau. Nothing would be done under the appropriate management tool to respond to this change in native plant communities.

A slow buildup of fine fuels in ponderosa woodlands would result from suppressing naturally occurring fires and could result in a large, difficult to manage fire. An intense fire in ponderosa woodlands, due to hazard fuel buildup, could cause crown fires of trees leading to ponderosa stand replacement, destroy the seed base, increase soil erosion, and destroy wildlife habitat, creating moderate to major adverse impacts in these areas. The pinyon juniper woodlands would continue to stagnate in an even aged stand type that would be more susceptible to large catastrophic fires.

Suppression activities may not be successful in all cases. Portions of the sagebrush and pinyon-juniper communities could burn, allowing the invasion of forbs and grasses, thus improving forage and wildlife habitat. Past fire activity has shown that the likelihood of severe wildfires on the Shivwits is rare due to the lack of ground fuel. However, as ground fuel increases over time, and if weather conditions are optimal for spread (high temperatures and wind), a large intensity wildfire could occur in the region. As described above, this could potentially damage the soil, kill vegetation, and open up more acreage, promoting the spread of non-native vegetation. The pinyon juniper community would continue in a monoculture stand replacement fire system that is less diverse than a mosaic community with a variety of age classes that is more beneficial to a wider range of species.

Cumulative Impacts

In the future, if a large, difficult to manage, wildland fire occurs in the Shivwits Region as a result of the full suppression program, it has the potential to spread and damage adjacent lands, including private lands, BLM administered lands, and adjacent Grand Canyon National Park. This would damage large portions of the Great Basin Desert and Colorado Plateau ecosystem, and could change the overall health of the regional vegetative community. Non-native vegetation could spread into the disturbed areas, outcompeting the native vegetation. Soil conditions could deteriorate as a result of sterilization from high intensity fires. Soil erosion could occur on a large scale. This could result in a decline of the health of the ecosystem in this region.

Conclusion

The implementation of a full suppression program within the recreation area would have beneficial effects on the low desert region of the recreation area, by preventing the spread of non-native species and protecting the desert vegetation and soils. The implementation of a full suppression program on the Shivwits Plateau would have moderate to major adverse impacts on the vegetative community, as the natural processes may not perpetuate. Hazard fuel build up would likley continue, and in the long-term, there would likely be large, difficult to manage and suppress, wildfires in the region. This option would probably perpetuate the less diverse monocultural vegetative community that is a result of previous full suppression policies. This could lead to the spread of non-native species, the sterilization of soils, and increase soil erosion in areas where these fires occur. This would likely occur on a localized basis, and not impact the overall area. Therefore, no impairment would occur as a result of this alternative.

Impacts from Alternative C: Combination of Wildland Fire Use and Suppression

Impacts from suppression activities in the Desert Fire Management unit would be the same as described under Alternative A. Impacts associated with wildland fire use on the Shivwits Plateau would be the same as described under Alternative A.

There would be impacts to vegetation associated with establishing a fuels management program in the interface unit of the recreation area. Native and non-native vegetation would be removed where determined necessary by fire management staff in order to protect residential areas, mobile home parks, commercial buildings, administrative sites and developed campgrounds, that

are within or directly adjacent to the Lake Mead NRA boundary. While this would result in direct impacts from destroying this vegetation, it would protect other vegetation within these zones from destruction from future wildland fires. It would primarily result in the removal of non-native vegetation in these areas. Maintenance would be necessary to prevent non-native vegetation from reestablishing in these zones after the initial removal. These impacts are considered minor as the overall viability of the plant community and soil structure would not be affected.

Cumulative Impacts
The cumulative impacts from this alternative would be the same as under alternative A. Overall, the health of the ecosystem on the Shivwits Plateau, and adjacent BLM administered lands, should continue to improve in the long-term. In addition, removing non-native plants from portions of the recreation area, including the riparian areas and around developed areas, should provide further protection to park resources from the spread of these non-native species.

Conclusion
As a result of implementing alternative C, there would be minor impacts in the lower desert unit to vegetation due to the construction of firelines. If wildland fires occur under the wildland fire use program on the Shivwits Plateau unit, vegetation would burn, and it could eventually result in an improved, more diverse vegetative community. There is the potential for non-native species to establish after a burn, which could alter the vegetative community of the area, and create moderate adverse impacts. The use of prescribed fire and herbicide treatment to eliminate non-native vegetation in springs and riparian areas would benefit native vegetation, soils, and habitat in those areas. The removal of native and non-native vegetation around at risk developed areas would damage vegetation, but this would affect primarily non-native vegetation. Therefore, this would be a beneficial impact, which could result in reduced spreading of non-native vegetation within the recreation area. There would be no impairment to vegetation and soils as a result of the impacts associated with this alternative.

WILDLIFE

Impacts from Alternative A: Continue with Current Management

Impacts Associated with Suppression Activities: Suppression activities would occur in the low desert portions of the recreation area, and in specific portions of the Shivwits Plateau area. The impacts associated with suppression activities include impacts related to the presence of fire crews, vehicle use, construction of firelines, use of tools and equipment, the use of aerial support, and the fire itself.

Fire crews and vehicles could damage wildlife habitat by trampling, on and off-road vehicle use, and by creating a disturbance which could cause displacement or abandonment. Nesting areas or burrows could be damaged from the construction of fire lines and trampling by large crews. The primary fireline utilized in the low desert is a small "scratch line." Large crews are generally not required for the small fires that occur in this region. Therefore, impacts from the construction of firelines and use of crews would be negligible to minor. Vehicles utilizing approved roads could cause mortality to wildlife on the roads. As stated in the mitigation section, all crews would be

instructed to drive slowly and avoid wildlife on the roads. This could reduce these impacts. In addition, off-road vehicle travel would be prohibited. Crews would access the fire on foot unless an approved road was present.

Aerial support, such as the use of large planes and helicopters on the fire, could temporarily disturb wildlife in the area. Occasional flight responses are expected. Mortality could also occur from the use of chemical retardant if small birds, mammals, and reptiles could not move away from the fire zone. These impacts are expected to be minor.

If fires occur and can not be immediately contained, or escape containment, mortality to small birds, mammals, and reptiles could occur in the fire zone, particularly to animals that can not move away from the fire. Since fires generally do not occur in these areas, habitat is available nearby, and occasional flight responses by wildlife are expected, this impact would be minor.

Impacts Associated with Wildland Fire Use: Wildland fire use would occur on the Shivwits portion of the recreation area. Impacts to wildlife associated with wildland fire use include impacts to wildlife and habitat from the fire, crews and vehicles, and the construction of firelines.

Wildlife that is mobile would move away from fire areas. Mortality of small vertebrates would occur, but not sufficient to affect populations. Wildlife could be temporarily displaced, and mortality may occur to those animals that are unable to move away from the fire. These impacts would be localized to the actual fire area. Fires could burn nest sites or burrows. Overall, in the long-term, fire would improve the overall quality of the wildlife habitat on the Shivwits by improving forage and creating forest mosaics.

Wildland fire use could increase the amount of snags that are valuable to many wildlife species. Habitat modification from wildland fire uses could eventually lead to shifts in species composition. Wildlife with specific habitat requirements or territorial animals with narrow ranges could be impacted by habitat loss or change.

Small crews of two to three people, or air support, could be dispatched to monitor the fire. The crews would access the fire by vehicles on approved roads, and by foot where roads are not present. Air support could be utilized to monitor the fire occasionally. This could temporarily disturb wildlife, but it would be negligible and should result in no long-term impacts to wildlife or wildlife habitat.

Firelines would be constructed and maintained around sensitive natural and cultural resources, and administrative sites. These small 2 to 3 foot wide firelines would remove a small portion of wildlife habitat from the Shivwits area, but this impact would be minor as other habitat is available nearby and mortality is not expected as a result of this activity.

Impacts associated with Non-Native Plant Control in Riparian Areas: Wildlife species would be temporarily displaced from the riparian areas during the treatment activities. There could be direct mortality of wildlife species unable to escape the fires. Mitigation, including timing of burns and pre-burn surveys for nesting sites, would reduce the potential impacts to nesting birds

in the riparian areas. Therefore, impacts would be minor. Follow-up treatment utilizing herbicide could again create temporary displacement of wildlife. The herbicide utilized in this program is species specific and does not impact wildlife. Studies have shown that species diversity of birds and insects increases directly with the amount of native vegetation present at a site and bird and insect bio-diversity decreases with increasing amounts of tamarisk at a site (Haigh, Sandra, 1997). In the long-term, as non-native vegetation is replaced with native species, the quality of the wildlife habitat would improve, creating beneficial impacts to wildlife.

Cumulative Impacts
Past burning activities have occurred primarily on the Shivwits Plateau. There have been very few burns in the lower desert. The burns on the Shivwits Plateau have led to increased biodiversity in some areas, improving the overall wildlife habitat. Future treatment programs would serve to improve the habitat if similar results occur.

Where burns did occur in the lower desert areas, recovery of the burned areas has been slow and non-native grasses have invaded. This has led to decreased forage and lower quality wildlife habitat. However, because fires are rare, this has only occurred in small portions of the recreation area, and habitat is available nearby, this impact is considered minor to moderate.

Conclusion
Fires that escape containment in the lower desert unit could degrade wildlife habitat and cause mortality to wildlife that is unable to escape the fire. This is unlikely, however, there is more potential for escape in moist years when grasses are present. The construction of firelines could temporarily displace or disturb wildlife. These impacts could create negligible to minor impacts.

Wildlife habitat would continue to improve under this program on the Shivwits Plateau. Mortality could occur to wildlife that can not move away from the wildland fire. Other wildlife could be temporarily displaced during fires. This could lead to negligible to minor impacts to wildlife and wildlife habitat. In general, wildland fires would improve the overall quality of the wildlife habitat on the Shivwits Plateau.

Riparian areas would continue to be restored under this alternative, and wildlife habitat would improve in these areas throughout the recreation area.

Since only small numbers of wildlife could be displaced or killed by wildland or prescribed fires, and no species would be permanently impacted by these activities, there would be no impairment to wildlife under this alternative.

Impacts from Alternative B: Full Suppression

The impacts associated with a full suppression program include impacts related to the use of fire crews, tools, and equipment, aerial support, construction of firelines, and, on the Shivwits Plateau, the impacts from not allowing natural fires to burn and the potential for future wildfires. The impacts associated with a full suppression program on the low desert portion of the recreation area would be the same as discussed under Impacts from Alternative A. The consequences of this alternative would differ in that full suppression would also be implemented on the Shivwits Plateau portion of the recreation area.

Suppression activities, including the use of fire crews, vehicles, aerial support, and the construction of firelines, would temporarily disturb wildlife, and destroy small portions wildlife habitat. Firelines would be constructed around fires. These small 2 to 3 foot wide firelines would remove a small portion of wildlife habitat from the Shivwits area, but this impact would be minor as other habitat is available nearby and mortality is not expected as a result of this activity. Trampling by larger fire crews dispatched to control the fire could damage wildlife habitat temporarily and disturb or displace wildlife, creating minor impacts to wildlife. The use of vehicles to transport crews and control the fire could temporarily disturb or displace wildlife. Vehicles would not be permitted off approved roads, unless authorized by the superintendent. Therefore, this impact would be restricted to road corridors and would be considered minor. Aerial support, including the use of planes and helicopters to control the fire, could temporarily disturb wildlife. Again, this would be a temporary, minor impact.

The primary impact from a full suppression program would be the continued reduced quality of wildlife habitat on the Shivwits Plateau, and the potential for a future, high intensity wildland fire. Past suppression and other human-caused disturbance has led to a monoculture community of sagebrush and pinyon-juniper in large portions of the Shivwits Plateau, with limited amounts of grasses and forbs, reducing the quality of habitat for wildlife. This habitat is likely to remain under the full suppression alternative. While this has not shown to threaten the continued existence of the wildlife species in the park, it has caused concern among wildlife managers. The vegetative treatment program, including the use of prescribed burns to accomplish management objectives, would create pockets of improved wildlife habitat. But this program is limited and may not accomplish all the wildlife management objectives for this region, and moderate to major impacts could occur as a result of implementing a full suppression program.

Suppression activities may not be successful in all cases. Portions of the sagebrush and pinyon-juniper communities could burn, allowing the establishment of forbs and grasses, and improving forage and wildlife habitat. A large, difficult to manage, wildfire could also occur as a result of the full suppression program. As all natural fires are prevented from burning, and floor litter and dead and down trees accumulate, the potential for an intense wildfire increases. A large, high intensity wildfire could damage large portions of wildlife habitat, result in direct mortality of wildlife, cause nest abandonment, and interfere with breeding seasons, resulting in major impacts to wildlife.

The impacts associated with non-native control in riparian areas would be the same as described under Alternative A.

Cumulative Impacts
Full suppression for the low desert region would result in the same cumulative impacts as described under Alternative A. Full suppression on the Shivwits Plateau region of the recreation area could result in long-term detrimental impacts to the health of the Colorado Plateau. If an intense, difficult to manage wildfire occurs as a result of the fuel accumulation that would occur under this alternative, it could spread outside the recreation area, onto BLM administered lands, or into Grand Canyon National Park. While control methods in the past have effectively halted the spread of wildfire, there is the potential that a wildfire could result in damage to the wildlife habitat of large portions of the Colorado Plateau, creating major impacts.

Conclusion
Fires that escape containment in the lower desert unit could degrade wildlife habitat and cause mortality to wildlife that is unable to escape the fire. This is unlikely, however, there is more potential for escape in moist years when grasses are present. The construction of firelines could temporarily displace or disturb wildlife. These impacts could create negligible to minor impacts.

Implementing a full suppression program could result in major impacts to the wildlife habitat of the Shivwits Region. It could lead to reduced quality of wildlife habitat. The accumulation of litter and dead and down trees as a result of this program could lead to a large, difficult to control, wildfire, which could cause direct mortality of wildlife, loss of wildlife habitat, and it could spread to adjacent lands. This could result in major impacts to wildlife and wildlife habitat in the region.

Riparian areas would continue to be restored under this alternative, and wildlife habitat would improve in these areas throughout the recreation area.

The implementation of a full suppression program could result in major impacts to wildlife and wildlife habitat. However, the vegetative treatment program would continue, protecting and improving habitat in portions of the Shivwits Plateau. This program could be expanded into the future, even under a full wildland fire suppression alternative. Therefore, the park's purpose of protecting wildlife and its habitat would continue to be fulfilled under this alternative, and it is unlikely that this alternative would constitute and impairment to wildlife and wildlife habitat.

Impacts from Alternative C: Combination of Wildland Fire Use and Suppression

The impacts from a full suppression program in the low desert regions of the recreation area would be the same as described under Alternative A and B.

The impacts associated with the wildland fire use program on the Shivwits Plateau would be the same as described under Alternative A.

The impacts associated with non-native control in riparian areas would be the same as described under Alternative A.

There would be minor impacts to wildlife species that occupy the interface zones. Clearing vegetation from selected interface areas would reduce the wildlife habitat in these areas, and would displace wildlife. Most of this habitat is not high quality wildlife habitat and is comprised of non-native species, plus there is a large amount of habitat available nearby, therefore, the impact would be minor.

Cumulative Impacts
Past burning activities have occurred primarily on the Shivwits Plateau. There have been very few burns in the lower desert, except for non-native tamarisk control. The management-ignited burns on the Shivwits Plateau have led to increased biodiversity in some areas, improving the overall wildlife habitat. Future treatment programs would serve to improve the habitat if similar results occur.

Where burns did occur in the lower desert areas, recovery of the burned areas has been slow and non-native grasses have invaded. This has led to decreased forage and lower quality wildlife habitat. However, because fires are rare, this has only occurred in small portions of the recreation area, and habitat is available nearby, this impact is considered minor to moderate.

Conclusion
Fires that escape containment in the lower desert unit could degrade wildlife habitat and cause mortality to wildlife that is unable to escape the fire. This is unlikely, however, there is more potential for escape in moist years when grasses are present. The construction of firelines could temporarily displace or disturb wildlife. These impacts could create negligible to minor impacts.

Wildlife habitat would continue to improve under this program on the Shivwits Plateau. Mortality could occur to wildlife that can not move away from the wildland fire. Other wildlife could be temporarily displaced during fires. This could lead to negligible to minor impacts to wildlife and wildlife habitat. In general, wildland fires would improve the overall quality of the wildlife habitat on the Shivwits Plateau.

Riparian areas would continue to be restored under this alternative, and wildlife habitat would improve in these areas throughout the recreation area.

Since only small numbers of wildlife could be displaced or killed by wildland fires or prescribed fires, and no species would be permanently impacted by these activities, there would be no impairment to wildlife under this alternative.

SENSITIVE, THREATENED AND ENDANGERED SPECIES

Impacts from Alternative A: Continue with Current Management

Impacts Associated with Suppression Activities: Suppression of fires in the low desert unit would protect the habitat of threatened and endangered species in this area. The species that could be affected in the low desert region of the recreation area from suppression activities include the threatened desert tortoise, and species of concern including the chuckwalla, banded gila monster, and Western burrowing owl.

Some of the suppression activities, such as the use of vehicles, fire crew activities, the construction of fire lines and the use of air tankers, could potentially adversely effect the desert tortoise and other sensitive species as listed above.

The desert tortoise inhabits portions of the low desert area, and fires have occurred in desert tortoise habitat within the recreation area. Mitigation developed in the past would be adopted at Lake Mead NRA (Appendix G), and would serve to protect the desert tortoise. A resource advisor would be present at all times during suppression activities, and would conduct site surveys prior to the construction of fire lines to ensure that tortoises and burrows are avoided. Additional mitigation measures are detailed in the mitigation section.

Even though this mitigation would be adopted, there still is the potential for desert tortoise to be injured or killed during suppression activities. If suppression activities fail, and the fire spreads, desert tortoises could be injured or killed if they are unable to move away from the fire. Desert tortoises may be moved, injured or killed by vehicle use in tortoise habitat. While most fires in the low desert are contained quickly, fires in years where there are abundant fine fuels, such as grasses, could spread rapidly and containment would not occur for several burn periods. Therefore, the impacts associated with full suppression activities on the low desert portion of the recreation area are likely to adversely affect the desert tortoise.

Other wildlife species of special concern in the low desert region that could be impacted from fires and suppression activities include the chuckwalla, banded Gila monster, and Western burrowing owl. Suppression activities could temporarily displace these species from impacts associated with disturbance, such as crew activities and the construction of firelines. If fires are not contained, loss of habitat could occur, and these species could be displaced, or direct mortality could occur if they were unable to move away from the fire. This would only occur in the rare circumstances where there are adequate grasses and forbs to carry the fire. Since the likelihood of this occurring is small, it would be a temporary impact to a small amount of acreage, and habitat is available nearby, this impact would be minor.

There is the potential that fires could occur elsewhere in the low desert during periods where annual vegetation is abundant. The suppression activities or the fires themselves could occur in habitats where sensitive vegetation exists, such as the Las Vegas bearpoppy (*Arctomecon californica*), sticky ringstem (*Anulocaulis leiosolenus*), threecorner milkvetch (*Astragalus geyeri* var. *triquetrus*), and the sticky buckwheat (*Eriogonum visicidulum*). These species could be burned if suppression activities are not successful. The likelihood of this occurring is small, and

areas of known or potential habitat would receive higher levels of protection, therefore, the impact would be minor to moderate.

Impacts Associated with Wildland Fire Use Activities: Wildland fire use would occur only on the Shivwits Plateau portion of the recreation area. There is no critical habitat located in this region. The threatened or endangered wildlife species that utilize or potentially utilize the Shivwits Plateau are birds and therefore generally mobile and able to move away from fire areas. The listed species that will be evaluated include the bald eagle, Mexican spotted owl, and California condor. In addition, impacts to the sensitive peregrine falcon, Northern goshawk, and the Grand Canyon rose and penstemon will also be analyzed.

The following activities associated with wildland fire use will be considered in this evaluation, including the use of crews, vehicles, tools and equipment, aerial support, the construction of firelines, and the burn itself. In addition, beneficial impacts from habitat improvement will also be analyzed.

The endangered bald eagle is a rare winter visitor, does not nest in the region, and would be able to move away from a wildland fire. It would be temporarily displaced from the area if a fire occurs during its migratory season in the winter. The chance of a wildland fire occurring during the winter months is extremely rare, and, according to NPS records, has not occurred in the recent past. Since this species could move away from a fire, and the likelihood of fire occurring in the region when the eagle is present is rare, there would be no adverse effect to this species. Fire could benefit the bald eagle by improving the overall habitat for wildlife, increasing prey species, and creating snags for roosting and hunting.

Potential habitat for the threatened Mexican spotted owl occurs on the Shivwits Plateau, though no occurrence has been recorded within or adjacent to the region during the first year of surveys. Generally, this species would relocate outside the burn area. Nest sites could be burned over during a wildland fire. If nests are found during monitoring activities, their location would be recorded and appropriate suppression activities would take place to protect the nests from adverse impacts. The Protected Activity Center guidelines in the Recovery Plan for the Mexican Spotted Owl (USDI 1995) would be followed. A suppression area of no less than 600 acres would be delineated around known nest sites.

However, even with surveys conducted in accordance with U.S. Fish and Wildlife Service protocol, and establishing suppression zones around known nest sites, there is the slight chance that nests could be damaged or destroyed during a wildland fire. Therefore, the wildland fire use program could result in a finding of likely to adversely affect. The beneficial impacts as a result of allowing fires to burn on the Shivwits regions could improve the quality of the wildlife habitat in the region, and could improve the habitat for the Mexican spotted owl by creating uneven-aged stands of mixed-conifer and pine-oak forests.

The California condor could occur within the Shivwits Plateau portion of the recreation area. The Arizona population of California condors is considered “experimental nonessential” by the U.S. Fish and Wildlife Service, and treated as a threatened species on NPS administered lands. The Shivwits Plateau region has suitable habitat for the condor, and they have been observed

nearby in Grand Canyon NP and on BLM administered lands. Impacts to this species are generally associated with the presence of humans. Mitigation measures were developed in coordination with the U.S. Fish and Wildlife Service for the *Vegetation Treatment and Hazard Fuel Reduction Environmental Assessment* (NPS 2002). These measures would be adopted under this plan to protect the condors. The continuation of a wildland fire program on the Shivwits Plateau is not likely to adversely effect the California condor.

Allowing wildland fire uses to occur would lead to improved habitat through the creation of uneven-aged stands, mosaic vegetation communities, and increased snags. Prior to recovery, suitable habitat is available throughout the area and on adjacent lands for use by these species.

The peregrine falcon inhabits the cliff portions of the Shivwits Plateau. While this species is no longer listed as threatened or endangered, it is still considered a sensitive species in the recreation area. The peregrine falcon primarily uses cliff sites for nesting and rarely uses old tree nests or cavities, therefore, the likelihood that nest sites would not be adversely impacted by fires is low. If nesting sites are found during seasonal monitoring or during fire monitoring activities, fire lines would be constructed around nest sites and appropriate suppression activities would occur to prevent adverse impacts to the peregrine falcon. Peregrine falcons could be temporarily displaced from their habitat due to fire activities and smoke. This would be a temporary, minor adverse effect.

Northern goshawk nests have been recorded in coniferous forests on the Shivwits Plateau and on adjacent BLM administered lands on the Arizona Strip. Known goshawk habitat would be designated as a suppression zone and appropriate suppression measures would be taken to minimize the adverse impacts. Even with the mitigation measures, unknown nest sites could be impacted from wildland fire activities. Goshawk nests could be destroyed by fire, and goshawks could be temporarily displaced due to fire activities and smoke. This could create minor to moderate impacts to the goshawk, as the fires may impact their nesting season, impacts would occur only on an occasional basis, and the fire activities would not threaten the continued existence of the species in the recreation area.

No threatened or endangered plants occur on the Shivwits Plateau, though two rare plants are known to exist in the region, the Grand Canyon rose (*Rosa stellata*) and *Penstemon distans*. Rare plant species habitat has been extensively surveyed and known habitat would be designated as suppression zones. Fire ecology of the Grand Canyon rose is unknown, however, other *Rosa* species resprout after low to moderately intense fires. High intensity fires could damage individual plants, and could reduce their populations and range, creating moderate to major impacts to this species. Appropriate protective measures, including the construction and maintenance of firelines around known habitat, would occur, therefore, sensitive plants would be protected from the fire activities.

Impacts associated with Non-Native Plant Control in Riparian Areas:
Non-native plant control activities occur in spring riparian areas within the recreation area. The method of control includes prescribed burning, followed by selective herbicide treatment, and planting of native vegetation. The listed and sensitive species associated with spring riparian areas within Lake Mead NRA include the endangered Southwestern willow flycatcher, the Yuma clapper rail, and the sensitive relict leopard frog. The impacts associated with non-native plant control include direct impacts from fire activities and herbicide treatment, disturbance impacts from the presence of fire crews and equipment, and temporary loss of habitat. Mitigation as described in the mitigation section prevents direct impacts to Southwestern willow flycatchers and the relict leopard frog. Most, if not all of the tamarisk prescribed burn treatment sites occur within areas that have no potential breeding habitat for Southwestern willow flycatchers according to the habitat guidelines referenced in Sogge, Marshall, Sferra and Tibbitts (Technical Report NPS/NAUCPRS/NRTR-97/12 A Southwestern Willow Flycatcher Natural History Summary and Survey Protocal, May 1997). However, this determination is still evaluated on a case by case basis of each treatment site prior to implementing a prescribed burn tamarisk control project.

If a treatment site is determined to contain potential Southwestern willow flycatcher or Yuma clapper rail habitat then indirect impacts from the temporary reduction in suitable habitat are likely to create temporary adverse impacts to these species. Pre-treatment surveys and avoiding treatment of known flycatchers and clapper rail habitat eliminate direct impacts to Southwestern willow flycatchers and Yuma clapper rail as a result of fire activities and disturbance from crews and equipment use. The Southwestern willow flycatcher and Yuma clapper rail could be temporarily displaced from treated spring areas until the native vegetation is restored, and suitable habitat is present. Past plantings in riparian areas have been highly successful. Native vegetation, such as cottonwoods and willows, has grown quickly in riparian areas, and the areas could provided suitable habitat in 5 to 7 years. Overall, the Southwestern willow flycatcher and the Yuma clapper rail would not likely be adversely effected by non-native vegetation control.

Mitigation will protect the relict leopard frog populations within the recreation area. Extensive monitoring is underway. Pre-treatment surveys would occur and areas with known populations of relict leopard frogs would not be burned. Instead of burning, the vegetation in these areas would be cut using hand tools and very selective target specific application of herbicide and with aquatic approved herbicides if necessary. Eventually, the spring areas would be restored and non-native plants would be reduced or eliminated, therefore, improving the habitat, resulting in beneficial impacts to the relict leopard frog. Tamarisk is known to consume large amounts of water and is capable of reducing water table and surface flow from springs and seeps therefor reducing potential relict frog habitat. Surface water is expected to increase with the removal of tamarisk therefore potential increasing relict leopard frog habitat.

Cumulative Impacts
Listed and sensitive species are protected throughout the recreation area. Programs such as the Clark County Multiple Species Habitat Conservation Plan and the Lower Colorado River Habitat Conservation Plan are ensuring the long-term protection of listed and sensitive species. The Protected Activity Center guidelines in the Recovery Plan for the Mexican Spotted Owl (USDI

1995) have been adopted on the Shivwits Plateau portion of the recreation area, and on adjacent NPS administered lands at Grand Canyon National Park.

Conclusion
Suppression activities are likely to adversely affect the desert tortoise as they may be moved, injured, or killed by vehicle use in tortoise habitat. In addition, suppression activities may not be successful and desert tortoise habitat could be temporarily damaged from fires and loss of habitat. A fire that can not be immediately contained could displace desert tortoise or cause direct mortality if tortoises could not move away from the fire. Mitigation would reduce these impacts, but can not completely eliminate the impacts. Other sensitive species, such as the chuckwalla, banded Gila monster, and the Western burrowing owl could be displaced due to suppression or fire activities. Known sensitive plant habitat in the low desert would be protected from fire.

In the wildland fire use zone of the Shivwits Plateau, the quality of habitat should improve over time. There would be no adverse impact to bald eagles. The Mexican spotted owl could likely be adversely affected if a wildland fire damages or destroys nest sites. The wildland fire program on the Shivwits Plateau is not likely to adversely effect the California condor.

Temporary minor, adverse impacts could occur to the peregrine falcon due to displacement from their habitat during fire activities. Minor to moderate adverse impacts could occur to Northern goshawks if unknown or unrecorded nest sites are destroyed by fire. No listed plant species occur on the Shivwits Plateau, however, sensitive and rare plants do occur. Known populations would be designated as suppression zones and protected from fires.

Non-native plant control in riparian areas would not likely adversely effect the Southwestern willow flycatcher, Yuma clapper rail, and the relict leopard frog, due primarily to the mitigation measures that would be adopted under all alternatives.

There would be no impairment to sensitive species as a result of implementing this alternative.

Impacts from Alternative B: Full Suppression

The impacts associated with a full suppression program include impacts related to the use of fire crews, tools, and equipment, aerial support, construction of firelines, and, on the Shivwits Plateau, the impacts from not allowing natural fires to burn and the potential for future wildfires.

The impacts associated with a full suppression program on the low desert portion of the recreation area would be the same as discussed under Impacts from Alternative A. Non-native vegetation treatment in springs would continue under this alternative, therefore, the impacts to sensitive, threatened and endangered species would be the same as described under Alternative A. The consequences of this alternative would differ in that full suppression would also be implemented on the Shivwits Plateau portion of the recreation area.

Implementing a full suppression program on the Shivwits Plateau portion of the recreation area could provide short-term protection from wildland fires to Mexican spotted owls, California

condors, bald eagles, and sensitive species such as peregrine falcons and Northern goshawk. However, there are potential short-term temporary impacts from the use of fire crews, equipment, and aerial support for fire suppression, and long-term impacts related to the continued reduced quality of wildlife habitat on the Shivwits Plateau and the potential for future, high intensity, wildland fires.

Fire crews, vehicles, and aerial support can temporarily disturb wildlife, including Mexican spotted owls, bald eagles, and can attract California condors. Since bald eagles are present on the Shivwits temporarily during winter migration, and wildland fires are highly unlikely to occur during this time, there would be no effect to the bald eagle as a result of disturbance from suppression activities. There could be minor, short-term impact to Mexican spotted owls from the construction of firelines by hand crews around known habitat or known nest sites. Aerial activities in potential habitat could temporarily disturb the Mexican spotted owl. Overall, nesting sites and known habitat would be protected by the suppression of all fires.

Human activities can attract California condors. Mitigation measures should prevent impacts to these birds, however, there is a slight chance that they could likely be adversely affected depending on where and when the suppression activities take place. Aerial support activities to control the fire could temporarily disturb condors.

The primary impact from a full suppression program would be the continued reduced quality of wildlife habitat on the Shivwits Plateau, and the potential for a future, high intensity wildland fire. Past suppression and other human-caused disturbance has led, in many places, to a monoculture community of sagebrush and pinyon-juniper. In addition, accumulation of dead and down timber, and floor litter, is present in some areas, and this is likely to increase in the future under a full suppression policy. The quality of habitat would improve somewhat in those area designated as vegetation treatment units in the *Vegetation Treatment and Hazard Fuel Reduction Plan*. Also, fuel accumulation would be reduced in those areas. However, this comprises a small percentage of the overall Shivwits region. Under a full suppression program, the wildlife habitat for most of the Shivwits region would not improve. The risk of a high intensity fire would remain. There would be no large-scale, or ecosystem-wide, beneficial impacts to the wildlife habitat.

Therefore, a full suppression program is likely to adversely affect threatened and endangered species, including the bald eagle, Mexican spotted owl, and California condor, and other sensitive species such as the Northern goshawk and peregrine falcon, in the long-term, by limiting the amount of high quality habitat that is available for these species on the Shivwits Plateau.

Rare and sensitive plant species would be protected from direct impacts associated with suppression activities under this alternative. However, if a large, difficult to manage wildland fire occurs as a result of a full suppression policy, even with protective measures in place, the fire may burn over areas of known sensitive or rare plant species, including the Grand Canyon rose. Fire ecology of the Grand Canyon rose is unknown, however, other *Rosa* species resprout after low to moderately intense fires. High intensity fires could damage individual plants, and could reduce their populations and range, creating moderate to major impacts to this species.

Cumulative Impacts
Full suppression for the low desert region would result in the same cumulative impacts as described under Alternative A. Full suppression on the Shivwits Plateau region of the recreation area could result in long-term detrimental impacts to the health of this region, and to the health of the Colorado Plateau ecosystem. If a large, difficult to manage wildland fire occurs as a result of the fuel accumulation that would occur under this alternative, it could spread onto adjacent BLM administered lands, and into Grand Canyon National Park. While control methods in the past have effectively halted the spread of wildfire, there is the potential that a wildfire could result in damage to the sensitive, threatened and endangered species habitat of large portions of the Colorado Plateau, creating major impacts.

Conclusion
Suppression activities in the low desert region of the recreation area are likely to adversely affect the desert tortoise as they may be moved, injured, or killed by vehicle use in tortoise habitat. In addition, suppression activities may not be successful and desert tortoise habitat could be temporarily damaged from fires and loss of habitat. A fire that can not be immediately contained could displace desert tortoise or cause direct mortality if tortoises could not move away from the fire. Mitigation would reduce these impacts, but can not completely eliminate the impacts. Other sensitive species, such as the chuckwalla, banded Gila monster, and the Western burrowing owl could be displaced due to suppression or fire activities. Known sensitive plant habitat in the low desert would be protected from fire.

Suppression activities on the Shivwits Plateau would reduce the quality of habitat over time. Therefore, a full suppression program is likely to adversely affect threatened and endangered species, including the bald eagle, Mexican spotted owl, and California condor, and other sensitive species such as the Northern goshawk and peregrine falcon, in the long-term, by limiting the amount of high quality habitat that is available for these species on the Shivwits Plateau.

A large, difficult to control, wildland fire could adversely impact sensitive and rare plants by burning individual plants and plant communities, reducing their overall populations and creating moderate to major impacts to these species.

Non-native plant control in riparian areas would not likely adversely effect the Southwestern willow flycatcher and the relict leopard frog, due primarily to the mitigation measures that would be adopted under all alternatives.

Overall, there would be no impairment to sensitive species as a result of the impacts associated with this alternative.

Impacts from Alternative C: Combination of Wildland Fire Use and Suppression

The impacts from a full suppression program in the low desert regions of the recreation area would be the same as described under Alternative A and B.

The impacts associated with the wildland fire use program on the Shivwits Plateau would be the same as described under Alternative A.

The impacts associated with non-native control in riparian areas would be the same as described under Alternative A.

Interface zones are located throughout the recreation area. These zones are generally comprised of non-native vegetation, such as eucalyptus, oleander, and tamarisk, and are located near development zones. It is highly unlikely that sensitive, threatened, and endangered species could occupy these zones. However, mitigation measures would be adopted, including pre-treatment surveys prior to cutting or burning of vegetation. If a sensitive or listed species if found, treatment activities would be halted.

Cumulative Impacts
Listed and sensitive species are protected throughout the recreation area. As described in Alternative A, there are many programs in place to provide for the long-term protection of listed and sensitive species. This alternative works towards that goal. It will protect the desert resources, and in the long-term, lead to improved wildlife habitat on the Shivwits Plateau.

Conclusion:
Suppression activities are likely to adversely affect the desert tortoise as they may be moved, injured, or killed by vehicle use in tortoise habitat. In addition, suppression activities may not be successful and desert tortoise habitat could be temporarily damaged from fires and loss of habitat. A fire that can not be immediately contained could displace desert tortoise or cause direct mortality if tortoises could not move away from the fire. Mitigation would reduce these impacts, but can not completely eliminate the impacts. Other sensitive species, such as the chuckwalla, banded Gila monster, and the Western burrowing owl could be displaced due to suppression or fire activities. Known sensitive plant habitat in the low desert would be protected from fire.

In the wildland fire use zone of the Shivwits Plateau, the quality of habitat should improve over time. There would be no adverse impact to bald eagles. The Mexican spotted owl could likely be adversely affected if a wildland fire damages or destroys nest sites. The wildland fire program on the Shivwits Plateau is not likely to adversely effect the California condor.

Temporary minor, adverse impacts could occur to the peregrine falcon due to displacement from their habitat during fire activities. Minor to moderate adverse impacts could occur to Northern goshawks if unknown or unrecorded nest sites are destroyed by fire. No listed plant species occur on the Shivwits Plateau, however, sensitive and rare plants do occur. Known populations would be designated as suppression zones and protected from fires.

Non-native plant control in riparian areas would not likely adversely effect the Southwestern willow flycatcher and the relict leopard frog, due primarily to the mitigation measures that would be adopted under all alternatives. Plant control and removal in interface zones would have no effect on sensitive or listed species.

There would be no impairment to sensitive species as a result of the impacts associated with this alternative.

AIR QUALITY AND VISIBILITY

Impacts from Alternative A: Continue Current Management

Impacts Associated with Suppression Activities: Suppression activities could create minor, temporary impacts to air quality in a localized area. Suppression activities that could potentially affect the air quality include use of vehicles, mechanized equipment such as chainsaws, heavy equipment, and aerial support. These activities could generate fumes in the form of smoke and exhaust from use of fossil fuels, and generate dust and particulate matter. This would affect air quality in the immediate area around the suppression activities on a short-term basis, creating minor temporary impacts.

Impacts Associated with Wildland Fire Use: Wildland fires could burn for more than several days, and smoke from these fires could affect air quality in the immediate area of the burn. Particulate matter less than 10 microns in diameter (PM-10) could be elevated locally. Particulate matter ratings are usually related to human health. These hazards would be minimal considering the remoteness of the Shivwits region. Prevailing winds and other weather factors would determine whether smoke from a wildland fire use affects air quality elsewhere. Smoke could affect Grand Canyon NP air quality, a Class I airshed, and points further east. This would be a temporary impact that would occur during fire activities, creating minor to moderate impacts.

Impacts associated with Non-Native Plant Control in Riparian Areas: Burning non-native vegetation would occur in selected springs and riparian areas. The smoke from these burns would create short-term, temporary impacts to air quality in the localized area. Prevailing winds and other weather factors would determine whether smoke from prescribed burning in riparian areas affects air quality elsewhere. Smoke could affect the air quality around the project site. This would be a temporary impact that would occur during fire activities, creating minor to moderate impacts.

Cumulative Impacts

Air quality is generally good within the recreation area, however, the frequency of days with poor air quality within the recreation area could increase as development and construction increases outside the park boundary in adjacent communities. Most of the air quality problems in the region are created by itinerant dust, motor vehicle exhaust, and power plant emissions. Continuing the current fire management activities would cause an increase in airborne pollutants over existing levels. These increases would be localized around the project sites, short-term, and insignificant in relation to the park and region's overall air quality and related values. The increase in airborne pollutants would not exceed national ambient air quality standards or allowable Class II requirements. In addition, county and state air quality requirements would be met during any fire-related activity.

Conclusion
Minor to moderate impacts to air quality from smoke, vehicle and equipment emissions, and dust, could occur on a temporary and localized basis during project work. National ambient air quality standards or allowable class II requirements would not be exceeded. There would be no impairment to air quality as a result of implementing Alternative A.

Impacts from Alternative B: Full Suppression

Due to the natural rate of fuel accumulation, fires would likely occur, even under a full suppression policy. These fires would create smoke that would impact air quality and the visual resources of Lake Mead NRA and Parashant NM, and adjacent BLM and NPS administered lands. Depending on prevailing winds and other weather factors, PM-10 values (the amount of particulate matter less than 10 microns in diameter) could be elevated in the region. Smoke from fires on the Shivwits Plateau could temporarily impact visual resources and air quality at Grand Canyon NP, a Class I airshed. This would be a temporary impact that would occur during fire activities, creating minor to moderate impacts.

Under this alternative, a large, difficult to manage, wildland fire could occur on the Shivwits Plateau region of the recreation area in the future due to hazard fuel accumulation. If a high intensity fire occurs in the region, suppression actions are unsuccessful and large acreages are burned, the smoke from the fire could create moderate to major impacts to the air quality in the region. It could reduce visibility of the recreation area, and adjacent lands, including Grand Canyon National Park for several weeks or months until full containment.

In addition, the use of vehicles, equipment, and aerial support for suppression activities could generate fumes from the use of fossil fuels, and create dust. This would occur on a temporary basis during the suppression activities, would be localized in the project area, and create minor impacts.

Impacts associated with Non-Native Plant Control in Riparian Areas: Same as described under Alternative A.

Cumulative Impacts
Cumulative impacts would be the same as described under Alternative A.

Conclusion
There would be minor to moderate impacts to air quality from suppression activities. If suppression fails, and/or a large, difficult to contain wildfire occurs, then there could be moderate to major temporary impacts to air quality in the region from smoke. No impairment to air quality would occur as a result of the impacts associated with this alternative.

Impacts from Alternative C: Combination of Wildland Fire Use and Suppression

Suppression activities on the low desert region of the recreation area would create the same impacts as those described under Alternative A. Wildland fire use activities would create the

same impacts as those described under Alternative A, as would impacts to air quality from non-native plant control.

Plant control and removal in the interface zone would create negligible impacts from the use of equipment and tools. These short-term temporary impacts relate to the fumes associated with the use of fossil fuels. These would be localized to the project area, and would not contribute to degradation of the recreation area air quality.

Cumulative Impacts
Same as described under Alternative A.

Conclusion
Minor to moderate impacts to air quality from smoke, vehicle and equipment emissions, and dust, could occur on a temporary and localized basis during project work. National ambient air quality standards or allowable Class II requirements would not be exceeded. There would be no impairment to air quality as a result of implementing Alternative B.

SCENIC QUALITY

Impacts from Alternative A: Continue Current Management

Impacts Associated with Suppression Activities: Suppression activities would occur in the low desert region of the recreation area and in specific areas of the Shivwits Plateau to protect park resources, including administrative sites, sensitive resources, and cultural sites. Firelines in the low desert area would be small scratch lines, removing primarily small bushes and shrubs, and annual vegetation. Impacts to the scenic quality of the area would occur until the desert vegetation recovers, which could be an extended period depending on weather and rainfall. However, these impacts would be considered negligible to minor as they would occur on a small scale and not detract from the scenic quality of the area.

On the Shivwits Plateau region of the recreation area, firelines would be larger and could involve the removal of shrubs, small and larger trees. This would leave an unnatural cut area that would recover over time, creating temporary, minor impacts to the scenic quality of the area. Use of helicopters and vehicles could temporarily detract from the scenic quality of the area by increasing particulate matter in the project area.

Impacts Associated with Wildland Fire Use: Smoke could temporarily detract from the view and have a minor to moderate negative impact on the visual resources during the wildland fire. The presence of burned areas and vegetation could detract from the scenic quality of the area. This impact would be short term until recovery occurs in the region, which could take several years. However, may people feel that a more open area, which would be a result of a larger wildland fire, is more scenic. Therefore, there could be beneficial impacts as a result of wildland fire use to the scenic resources of the Shivwits Plateau.

Impacts associated with Non-Native Plant Control in Riparian Areas: Tamarisk creates a monoculture of vegetation in spring and riparian areas, and detracts from the scenic values of

those areas. While there would be temporary negative impacts from the prescribed fire activities, including smoke and burned areas, there would be long-term positive impacts from the replacement of non-native vegetation to native riparian vegetation.

Cumulative Impacts
The scenic resources of the recreation area are currently being impacted by development within and outside the recreation area boundaries, illegal off-road vehicle use, road construction projects and existing road corridors, vegetation treatment activities within and outside the recreation area boundaries, air quality concerns, light pollution, and existing utility corridors and towers. Suppression activities, wildland fire use, and non-native plant control in riparian areas would not significantly add to these cumulative impacts. Project activities would only temporarily detract from the scenic quality of the area, therefore, these impacts from these activities would be minor.

Conclusion
The impacts to the scenic quality of the low desert region from fire suppression and non-native plant control activities would be minor as they would occur on a small scale and would not detract for the scenic quality of the area. Temporary minor impacts to the scenic quality of the Shivwits Plateau region could occur from fireline construction, smoke and air quality, and by the creation of burned areas. As more open forests areas are created by wildland fire use, there could be beneficial impacts to the scenic quality of the region. There would be no impairment to the scenic resources in the area as a result of the impacts associated with this alternative.

Impacts from Alternative B: Full Suppression
Impacts to the low desert region of the recreation area would be the same as described under Alternative A. Suppression activities on the Shivwits Plateau region would be more aggressive under this alternative. Therefore, impacts could be more severe. Construction of firelines, roads, helispots, fire camps, dye from retardant drops, and cutting trees to stump, and other associated suppression activities, could decrease the scenic and visual quality of the area and increase particulate matter in the area. These impacts could range from minor to major depending on the scope and size of the suppression function.

If suppression activities are unsuccessful and a large fire occurs on the Shivwits Plateau, there could be moderate impacts to the scenic quality of the area by the appearance of burned out areas and burned vegetation. This impact would remain until recovery occurs in the area, which could take decades, depending on the amount of acreage involved in the fire and the intensity of the fire. The higher intensity fires would create more severe impacts as recovery would take more time.

The impacts from the non-native plant control program in riparian areas would be the same as described under Alternative A.

Cumulative Impacts
Cumulative impacts would be the same as described under Alternative A. However, there is the potential for further impacts to the scenic quality of the region under this alternative if a high intensity, large scale, uncontrollable fire occurs on the Shivwits Plateau, and spreads into

adjacent areas. The visual resources would be impacted by the construction of firelines, cutting of trees and shrubs, use of heavy equipment, use of retardant, and the burn itself. Rehabilitation would occur over time.

Conclusion
The impacts to the scenic quality of the low desert region from fire suppression and non-native plant control activities would be minor as they would occur on a small scale and would not detract for the scenic quality of the area. Suppression activities on the Shivwits Plateau could create minor to major impacts, depending on the scope and size of the suppression function. If suppression activities are unsuccessful, and a large fire occurs on the Shivwits Plateau, there could be moderate impacts to the scenic quality of the area. There would be no impairment to the scenic quality of the recreation area as a result of the impacts associated with this alternative.

Impacts from Alternative C: Combination of Wildland Fire Use and Suppression

Impacts on the low desert portion of Lake Mead NRA where suppression activities would occur would have the same impacts as described under Alternative A. Impacts to the Shivwits Plateau region of the recreation area would have the same impacts as described under Alternative A. Impacts from non-native plant control would be the same as described under Alternative A.

Vegetation could be removed in the urban interface zones. This could make adjacent properties, and developed areas within the recreation area, more visible, thus detracting from the natural scenic views. This would only occur where human development is already present, and visitors have expectations of buildings and structures. Thus the impact would be negligible.

Cumulative Impacts
Cumulative impacts would be the same as described under Alternative A.

Conclusion
The impacts to the scenic quality of the low desert region from fire suppression and non-native plant control activities would be minor as they would occur on a small scale and would not detract for the scenic quality of the area. Temporary minor impacts to the scenic quality of the Shivwits Plateau region could occur from fireline construction, smoke and air quality, and by the creation of burned areas. As more open forests areas are created by wildland fire use, there could be beneficial impacts to the scenic quality of the region. There would be no impairment to the scenic resources in the area as a result of the impacts associated with this alternative.

WATER RESOURCES, INCLUDING RIPARIAN AREAS AND WETLAND

Impacts from Alternative A: Continue with Current Management

Impacts Associated with Suppression Activities: Suppression activities in the low desert could utilize water from Lakes Mead or Mohave, whether it is pulled directly from the lakes or through the existing water system. However, due to the rarity of wildfires in the recreation area's low desert, and the limited acreage typical with these types of fires, water use for fires would have only a negligible effect on the overall water allotment for Lake Mead NRA. Water use and the

construction of firelines could cause erosion on a localized basis, leading to slight water runoff. Generally, the firelines constructed in the low desert region are scratch lines. In addition, natural barriers and roads are used as firelines where possible. Runoff is not expected to occur, and the water quality of the lakes would not be affected. Therefore, the overall water system and flow would not be impacted by suppression activities. There would be no effect to water quality.

Some fires have occurred in the riparian areas around the lakes, primarily in areas of non-native tamarisk. Appropriate suppression would occur in these areas, and water resources could be used to extinguish the fires. However, these fires are rare, generally burn out after the fuel source is depleted, and water use would be limited and would have only a negligible effect on the overall water allotment for Lake Mead NRA. In addition, since non-native vegetation would be removed through the use of fire, the burned area could be revegetated with native vegetation, therefore improving the quality of the riparian shoreline in these areas over time.

Impacts Associated with Wildland Fire Use: Wildland fire use would occur where appropriate on the Shivwits Plateau region of the recreation area. This area is on a plateau approximately 6,200 feet above sea level, and it is separated from the Colorado River by at least 10 air miles. The mean annual precipitation in this area is 13 to 17 inches with no flooding on 0 to 6% slopes, according to the Natural Resource Conservation Service soil survey. While slight erosion could occur after a burn, until vegetation is reestablished, this erosion would not affect the Colorado River resources or water quality.

Water resources in springs on the Shivwits Plateau could be slightly adversely impacted by run-off and erosion after fire events. Riparian areas are generally able to repel fires due to their cool, moist microclimate. However, escape fires could occur here. Appropriate suppression actions would be taken to prevent riparian areas from burning. Fire which consumes streamside vegetation or upslope cover would have temporary adverse impacts on riparian communities, including loss of cover, and increased erosion leading to decreased water quality.

Water resources on the Shivwits could be utilized during suppression activities in designated suppression zones, or if a fire burned out of prescription. For the most part, an engine or water tender would bring water from off-site and would be used to fill a portable water tank. Water in the existing well adjacent to the recreation area could be utilized to suppress fires. At a maximum, 1,000 gallons would be drawn from the well in initial attack. The existing cattle tanks on the Shivwits Plateau would not be utilized as a water source as they are generally not deep enough. Water tenders would be utilized and relied upon during latter stages of initial attack and extended attack phases of fire suppression. Therefore, the water supply on the Shivwits would not be adversely impacted from suppression activities.

Impacts associated with Non-Native Plant Control in Riparian Areas: Burning and herbicide use could impact water quality in spring areas by creating conditions that could contribute to erosion and through contamination of water resources by herbicide use. Past treatment activities have not shown an increase in erosion, as native vegetation re-established naturally shortly after the treatment activities. The natural re-establishment is also supplemented by the planting of native trees and shrubs. The reduction or elimination of non-native tamarisk in spring and riparian areas should, in the long-term, improve the water quality in these areas by reducing the salinity

of the soil surface and subsequent runoff into the springs. Native grasses and shrubs usually colonize the areas previously infested by tamarisk. Tamarisk thickets can cause channelization of stream channels which leads to increase soil erosion and a reduction of water quality from sedimentation. However the native grasses and shrubs that recover after tamarisk removal have fiberous roots that reduce soil erosion and water run-off.

Herbicide application methods are designed to avoid water contamination. Only aquatic approved herbicides are permitted to be applied directly into the water. All herbicides are applied according to label. Herbicide is not applied during windy conditions or in conditions that would allow for spray drift to enter the water. Garlon 4 herbicide is applied to tamarisk re-sprouts in areas void of surface water and Rodeo, an aquatic approved herbicide, is used in areas where herbicide application will contact surface water. If Garlon 4 is inadvertantly applied to water, then only very small amounts (1 to 2 ounces) are emitted from the sprayers at a time and will be quickly diluted in the water body. This small amount of Garlon 4 is not enough volume to have negative impacts on aquatic biota according to laboratory lethal dose tests on aquatic animals. Garlon 4 also breaks down in water within 48 hours. The herbicide mixture includes Garlon 4 mixed with a vegetable based oil instead of a petroleum based oil to reduce impacts to the soil and water resources.

Cumulative Impacts

The water quality concerns within Lake Mead NRA have focused on the inflow area at Las Vegas Wash and at the intake areas for the Southern Nevada Water System. Water quality issues are becoming a concern in the Virgin River inflow area, as communities along the Virgin River grow. In addition, the use of motorized vessels and the disposal of human waste in the lakes can lead to reduced water quality. The negligible to minor impacts as a result of this alternative would not contribute overall to these water quality issues, and would not result in a degradation of water quality in the recreation area.

Conclusion

Suppression activities would have no impact to water quality and would create negligible impacts to water resources by utilizing small quantities of Lake Mead NRA's water allotment. Wildland fire use would have no effect to the Colorado River resources or water quality. Minor, negligible impacts to springs and riparian areas on the Shivwits Plateau could occur because of run-off from burn areas, or erosion caused by suppression techniques. Minor impacts to the water table could occur from utilizing water from wells during suppression efforts. Burning and herbicide use in riparian areas in the low desert could have temporary, minor impacts to water quality. These impacts are negated by the beneficial impact to the water quality of removing tamarisk that would lead to an increase in water volume and a potential reduction in salinity of runoff into water resources. There would be no impairment to water quality and riparian areas as a result of the impacts associated with this alternative.

Impacts from Alternative B: Full Suppression:

Suppression activities in the low desert portions of the recreation area would be the same as described under Alternative A. Suppression activities on the Shivwits Plateau region of the recreation area could slightly adversely affect water quality and water resources.

Water resources on the Shivwits could be utilized during suppression activities. Water in existing wells and cattle tanks could be utilized to suppress fires. The utilization of the existing water sources on the Shivwits Plateau could reduce the amount of water available to wildlife and cattle. The intensity of this impact would relate to the conditions on the Shivwits. During drought conditions, most cattle tanks have little water or are dry, therefore, the wells would be utilized.

Water resources in springs on the Shivwits Plateau could be slightly adversely impacted by run-off and erosion after fire events. Riparian areas are generally able to repel fires due to their cool, moist microclimate. However, escape fires could occur here. Appropriate suppression actions would be taken to prevent riparian areas from burning. Fire which consumes streamside vegetation or upslope cover would have temporary adverse impacts on riparian communities, including loss of cover, and increased erosion leading to decreased water quality.

If suppression activities fail, and a high intensity wildland fire burns large acreages, a result of this could be an increase in erosion. Runoff and erosion would still not impact the Colorado River resources, but could negatively impact nearby springs and riparian areas, increasing the sediment load and reducing water quality. This impact would be minor, until vegetation is re-established in the burned area. This would be a temporary impact, depending on the rehabilitation efforts, the seed sources, and rainfall. This temporary impact would depend on the rehabilitation efforts, natural plant recovery and the amount of precipitation. It is reasonable to expect that recovery would occur within 2 to 10 years depending on various biological and environmental conditions.

Burning and herbicide use in riparian areas in the low desert could have temporary, minor impacts to the water quality due to increased runoff and sediment accumulation from a lack of vegetative cover. These impacts are negated within two years following tamarisk removal by the recovery of desirable plants. Lake Mead NRA post treatment monitoring from previous tamarisk control projects has shown that native plants re-colonize the bare ground within two years due to an increase in soil moisture caused by the removal of tamarisk (Deuser pers.comm.). There would be no impairment to water quality and riparian areas as a result of the impacts associated with this alternative.

Impacts associated with non-native plant control in riparian areas to water resources would be the same as described under Alternative A.

Cumulative Impacts
The cumulative impacts from this alternative would be the same as described under Alternative A.

Conclusion
Suppression activities in the low desert portion of the recreation area would have no impact to water quality and would only negligible impacts by utilizing portions of Lake Mead NRA's water allotment. Wildland fire use would have no effect to the Colorado River resources or water quality. Minor, negligible impacts to springs and riparian areas on the Shivwits Plateau could

occur because of run-off from burn areas, or erosion caused by suppression techniques. Minor adverse impacts to the water table could occur from utilizing water from wells during suppression efforts. If suppression actions fail, and a high intensity wildland fire occurs, minor, negative impacts could occur to nearby springs and riparian areas as a result of run-off and erosion. This would be a temporary impact depending on the rehabilitation efforts, available seed sources, and rainfall.

Burning and herbicide use in riparian areas in the low desert could have temporary, minor impacts to the water quality. These impacts are negated by the beneficial impact to the water quality of removing tamarisk that would lead to a reduction in salinity of the water resources in treated springs. There would be no impairment to water quality and riparian areas as a result of the impacts associated with this alternative.

Impacts from Alternative C: Combination of Wildland Fire Use and Suppression

This alternative is similar to Alternative A, and the impacts from suppression activities, wildland fire use, and non-native plant control would be the same as described under Alternative A.

There would be no or negligible impacts to water quality associated with removing plants in the urban interface areas under this alternative.

Cumulative Impacts

The cumulative impacts as a result of this alternative would be the same as described under Alternative A.

Conclusion

Suppression activities would have no impact to water quality and would create negligible impacts to water resources by utilizing portions of Lake Mead NRA's water allotment. Wildland fire use would have no effect to the Colorado River resources or water quality. Minor, negligible impacts to springs and riparian areas on the Shivwits Plateau could occur because of run-off from burn areas, or erosion caused by suppression techniques. Minor impacts to the water table could occur from utilizing water from wells during suppression efforts. Burning and herbicide use in riparian areas in the low desert could have temporary, minor impacts to water quality. These impacts are negated by the beneficial impact to the water quality of removing tamarisk that would lead to a reduction in salinity of the water resources in treated springs. These impacts are negated within two years following tamarisk removal by the recovery of desirable plants. Post treatment monitoring from previous tamarisk control projects has shown that native plants re-colonize the bare ground within two years due to an increase in soil moisture caused by the removal of tamarisk.

There would be no impairment to water quality and riparian areas as a result of the impacts associated with this alternative.

VISITOR USE AND EXPERIENCE

Impacts from Alternative A: Continue Current Management

Impacts Associated with Suppression Activities: Full suppression would continue to occur for any fire in the low desert portion of the recreation area. Visitor access would be prohibited in fire areas during suppression activities. This would be a temporary, short-term impact that occurs during the fire suppression activities.

Impacts Associated with Wildland Fire Use: During a wildland fire, the fire perimeter would be closed to visitor access. Although burn areas might at first detract from the visitor experience, eventually the view shed could improve due to more open areas created by wildland fire use.

Impacts associated with Non-Native Plant Control in Riparian Areas: Riparian areas would be temporarily closed to visitor access during the treatment activities. Prior to recovery, visitors may be detracted from the appearance of burned and dead tamarisk. This would be a temporary impact as spring areas have been shown to recover and revegetate in 1 to 2 years.

Cumulative Impacts
Visitors are temporarily displaced from nearby areas when treatment activities or fires are occurring, including adjacent BLM administered lands. Restrictions from areas at Lake Mead NRA would add additional acreage where visitor use is temporarily restricted. However, there is a large amount of acreage elsewhere in the region, and access roads outside the treatment areas would remain open to visitors. However, visitors may not be able to visit their preferred or planned area. Mitigation includes press releases, public notifications, and signs to notify visitors. The impact from closures could be minor to major, depending on the visitor's plans and flexibility, and the amount of open acreage available nearby for visitor use.

There may be periods when managers determine that the danger of fires is so extreme that the entire region is closed to visitor access. This could occur in areas throughout the Southwest, severely limiting the amount of acreage available for visitor use and recreation. Closures could create major impacts to visitor use in the area. However, the closures serve to protect the visitors, and protect the resources for future visitor use, therefore, positive, long-term benefits would occur to visitor use.

Conclusion
Impacts to visitor use range from minor to major, depending on the amount of acreage closed to visitor access, the amount of acreage available nearby, and the visitor's intention and flexibility. Overall, closures occur to protect the visitors, and protect the resources for future visitor use. Therefore, therefore, in the long-term, there would be positive impacts to visitor use from temporary closures.

Impacts from Alternative B: Full Suppression

Visitor access would be temporarily restricted in fire areas during suppression activities. If fires can not be contained, the fire perimeter and adjacent areas would be temporarily closed to visitor access. The impact to visitors could be minor to major, depending on the amount of open areas nearby and the flexibility of the visitors.

Cumulative Impacts
The cumulative impacts as a result of this alternative would be the same as described under Alternative A.

Conclusion
Impacts to visitor use range from minor to major, depending on the amount of acreage closed to visitor access, the amount of acreage available nearby, and the visitor's intention and flexibility. Overall, closures occur to protect the visitors, and protect the resources for future visitor use. Therefore, therefore, in the long-term, there would be positive impacts to visitor use from temporary closures.

Impacts from Alternative C: Combination of Wildland Fire Use and Suppression

The impacts from this alternative are the same as described under Alternative A.

Cumulative Impacts
The cumulative impacts as a result of this alternative would be the same as described under Alternative A.

Conclusion
Impacts to visitor use range from minor to major, depending on the amount of acreage closed to visitor access, the amount of acreage available nearby, and the visitor's intention and flexibility. Overall, closures occur to protect the visitors, and protect the resources for future visitor use. Therefore, therefore, in the long-term, there would be positive impacts to visitor use from temporary closures.

GRAZING AND SOCIOECONOMIC RESOURCES

Impacts from Alternative A: Continue Current Management

Impacts Associated with Suppression Activities: Grazing activities in the low desert portion of the recreation area could be temporarily suspended during fire and suppression activities. Grazing allotment managers would work with NPS biologists to determine when grazing can be reestablished in existing grazing allotments.

Impacts Associated with Wildland Fire Use: Grazing activities would be temporarily suspended during wildland fire uses, and for a period following the fire to allow for habitat recovery. The time involved for habitat recovery depends on the rate of recovery. Biologists from the NPS and BLM would work to evaluate the range conditions and determine when grazing can be re-established in existing open allotments. The range condition could eventually improve due to the creation of vegetation mosaics, and the growth of grasses and forbs after the fire.

Impacts associated with Non-Native Plant Control in Riparian Areas: There would be no impacts to grazing and socioeconomic resources due to non-native plant control in riparian areas.

Cumulative Impacts
Wildland fire use in appropriate areas could improve the overall grazing conditions over time.

Conclusion
Temporary minor to moderate negative impacts could occur to grazing, depending on the location and duration of wildland fires and suppression activities, and the rate of recovery. In the long-term, beneficial impacts on the Shivwits Plateau portion of the recreation area would occur as native plant community re-establishes in the area, natural process are restored, and range conditions are improved.

Impacts from Alternative B: Full Suppression

Suppression activities could temporarily limit access to areas during fires. Cattle may need to be moved from areas where fires occur. Grazing would be negatively impacted if high intensity fires escape initial attack efforts, as cattle would need to be removed from the burned area until it recovers, which would be a period of at least two years.

Cumulative Impacts
Suppression activities within the recreation area and on adjacent lands have led to increased fuel loads and dead and down timber. Under a program of full suppression, the fuel loads would continue to increase, and this could result in an intense, difficult to suppress wildfire. High intensity fires could escape containment and burn large acreages on the Shivwits Plateau, and these fires could spread into adjacent areas. This could severely impact the grazing operations of the region, as intense, hot wildfires could burn large acreages, sterilize the soil, and increase recovery time, thus increasing the time the existing allotments are closed to grazing operations within and outside the recreation area boundaries.

Conclusion
Fires and suppression activities could temporarily reduce the amount of acreage available to grazing activities. If a large, intense, fire occurs in the region, grazing operations could be severely impacted by closures.

Impacts from Alternative C: Combination of Wildland Fire Use and Suppression

Grazing activities would be temporarily suspended during wildland fire uses, and following the fire to allow for habitat recovery. Biologists from the NPS and BLM would work to evaluate the range conditions and determine when grazing can be re-established in existing open allotments. The range condition could eventually improve due to the creation of vegetation mosaics, and the growth of grasses and forbs after the fire.

Cumulative Impacts
The cumulative impacts would be the same as described under Alternative A.

Conclusion
Temporary minor to moderate negative impacts could occur to grazing, depending on the location and duration of wildland fires and suppression activities, and the rate of recovery. In the long-term, beneficial impacts on the Shivwits Plateau portion of the recreation area would occur as native plant community re-establishes in the area, natural process are restored, and range conditions are improved.

CULTURAL RESOURCES
The effects of fire management actions on cultural resources under the alternatives are divided into direct, operational and indirect categories. Direct effects are those where the fire itself is the cause of the impacts, operational effects occur as a result of associated operations like line construction or staging, while indirect effects are where fire and/or associated operations result in changes to local context such that resources will be affected.

Impacts from Alternative A – No Action – Continue with current management

<u>Impacts associated with wildland fire use, prescribed fire, and suppression activities</u>

<u>Direct Effects:</u> Fire suppression zones would be designated around known cultural resources that could be damaged or destroyed by fire, i.e. wood structures, petroglyph sites, etc. Appropriate suppression activities would occur within this zone to prevent damage to these resources. Therefore, there would be no direct effect to known cultural resources.

On archeological sites the amount of damage to surface and subsurface resources depends on fire intensity. Minimal or no damage would occur to commonly found surface artifacts, such as flaked stone, ground stone, and ceramics, from low-intensity fires. High intensity fires could cause damage to surface and subsurface resources by shattering flaked stone and ground stone artifacts, warping ceramics and burning paint, and burning organic materials such as bone, seeds, and pollen.

Operational Effects: Fireline construction, staging, mop-up and rehabilitation and looting are probably the great threat for operational effects on resources of interest at Lake Mead NRA. These impacts are most likely to occur during wildfire events, or at least at the greatest scale and intensity. This is problematical in that such disturbances often occur in areas that lack cultural resource inventories, and without input from a qualified Cultural Resource Specialist.

Fireline construction, staging, mop-up and rehabilitation will almost always entail ground disturbance caused by implements ranging from hand tools to heavy equipment. Damage related to these disturbances will usually take the form of cultural resource breakage or displacement. Generally speaking, heavy equipment, which is most likely to be used during wildfire suppression, poses the greatest threat to resources of interest since a large amount of material can be moved very quickly. As with direct effects, those resources of interest located above or on the ground surface are the most likely to be impacted by ground disturbance. It is suggested that, all else being equal, that archeological sites without features (e.g., lithic scatters, trash scatters) are less vulnerable to ground disturbing operational effects than archeological sites and other resources of interest that posses surface or shallowly buried features. Finally, conspicuous features such as standing structures are more likely to be recognized and avoided than less obvious ones such as lithic scatters or collapsed fencelines.

Looting will generally entail the theft or vandalism of resources of interest by fire personnel. It can also involve inappropriate behavior in proximity to resources of importance to Native Americans such as Traditional Cultural Properties and ethnographic landscapes. Resources of interest located near firelines, staging areas, fire camps and similar phenomena are most threatened by operational looting. Theft and vandalism are expected to be most prevalent in surface or shallowly buried archeological sites containing readily identifiable whole or fragmentary artifacts (e.g., projectile points, bottles, Native American ceramics) and rock imagery sites.

Indirect Effects: Indirect fire effects are a potential threat to archeological resources following all prescribed and wildland fires.

Among the indirect effects on cultural resources at Lake Mead NRA and Parashant NM, increased surface runoff and erosion, increased tree mortality, carbon contamination and looting are suspected to be the most detrimental. Erosion and looting are prone to occur anywhere in Lake Mead NRA and Parashant NM, while impacts of increased tree mortality and carbon contamination would probably be most pronounced on the Shivwits Plateau.

Soils in the lower desert region of Lake Mead NRA tend to be shallow, very rocky, poorly developed and sparsely vegetated. Alluvial deposits are common on the Shivwits Plateau, and erosion and sedimentation are major concerns. Fire-induced erosion would generally be most pronounced following high intensity burns. Resources of interest located on unstable landforms (e.g., on or adjacent to steep slopes) are considered to be the most vulnerable, as are ones containing intact surface or subsurface features (e.g., Native American villages).

Increased tree mortality can occur in stands of pinyon-juniper and ponderosa pine on the Shivwits Plateau. Increased fuel loads from downed trees threaten all resources of interest, while

those with intact surface and subsurface features and deposits are particularly vulnerable to damage from falling trees. An associated impact is carbon contamination in Native American archeological sites. This could occur as surface charcoal incorporated into subsurface deposits and features through various means, or burned conifer roots within archeological sites. Again, Native American villages and other sites with subsurface features and deposit are prone to this impact.

Finally, looting may be exacerbated following fire events. Burned areas are often attractive due to improved ground visibility. While large areas of Lake Mead NRA are sparsely vegetated, ground exposure is increased following fires on the Shivwits Plateau. The scale of looting ranges from incidental artifact collection to large-scale commercial ventures. As with operational looting, is anticipated that surface or shallowly buried archeological sites containing recognizable artifacts are most vulnerable, although illegal excavation is a concern in certain contexts such as historic trash scatters and Native American village sites. In some cases, sensitive resources such as rock imagery exposed by fire become more vulnerable to vandalism.

Beneficial Impacts: Ongoing treatment and mechanical activities should reduce the potential for a catastrophic wildfire, and significantly reduce the risk to known historic and cultural resources on the Shivwits Plateau.

Cumulative Impacts: Overtime, as more acres are burned within the recreation area, and in adjoining areas, in accordance with the fire management strategies, more surveys for cultural resources would be completed. More would be known about cultural sites, and more areas would be protected as they would be designated as suppression or mechanical treatment zones.

Conclusion: Known cultural resources that could be damaged or destroyed by fire would be contained within fire suppression zones. Therefore, there would be no impact to known resources under this alternative. Archeological resources should not be impacted by the low intensity fires associated with this alternative, however, high-intensity fires could damage these resources. Secondary impacts may include exposure of previously covered cultural resources as a result of soil erosion or trampling and ground disturbance during prescribed fire activities. Mitigation, including an on-site cultural resource specialist during suppression and treatment activities, would reduce the impacts to moderate to minor. There would be no impairment to cultural resources from the impacts of this alternative.

Impacts from Alternative B: Full Suppression

Impacts from alternative B relate to the direct effects from fires that are difficult to suppress or catastrophic wildfires, the operational effects as a result of suppression efforts, and the indirect effects from a full suppression program.

Direct Effects: While the goal of this alternative is to suppress all wildfires within the recreation area, there is the potential that over time, particularly with the fuel accumulation anticipated on the Shivwits Plateau, that a catastrophic wildfire would occur. A catastrophic wildfire would result in a higher temperature burn with increased fire intensity and duration, which could damage even the most durable cultural resources. This could result in major direct adverse impacts to surface materials.

Operational Effects: The operational effects associated with fire suppression activities would be the same as discussed in alternative A. This includes impacts from ground-disturbing activities such as fireline construction, staging, mop-up and rehabilitation. The disturbances take the form of cultural resources breakage or displacement. Heavy equipment, which is most likely to be used during wildfire suppression, poses the greatest threat to resources of interest since a large amount of material can be moved very quickly. The resources most likely to be impacted are those located above or on the ground surface. Conspicuous features such as standing structures are more likely to be recognized and avoided than less obvious ones such as lithic scatters or collapsed fencelines.

Looting can also be a result of a full suppression program since more personnel will be on-site during these activities and resources can be exposed around firelines, staging areas, fire camps, and similar activities.

Indirect Effects: The indirect effects from this alternative would occur if a full suppression program led to a catastrophic wildfire on the Shivwits Plateau. This is likely if full accumulation is allowed to continue to increase, and the natural fire processes are not restored in the area. A high intensity catastrophic wildfire on the Shivwits Plateau would result in increased erosion and surface run-off, increased tree mortality, carbon contamination of cultural resources, and potential looting or exposed cultural resources.

Cumulative Impacts
There is more potential for a larger, difficult to control wildfire that could damage cultural resources within and outside the recreation area.

Conclusion
Cultural resources could be damaged under a full suppression program from direct and indirect effects from a catastrophic wildfire, and operational effects related to suppression activities. This alternative would result in moderate to major impacts to cultural resources, and could result in permanent, irretrievable impacts to cultural resources.

Impacts from Alternative C: Combination of Wildland Fire Use and Suppression
The impacts associated with this alternative would be the same as described under alternative A, with the addition of the following beneficial impacts.

Beneficial Impacts
Impacts of fire management actions at Lake Mead NRA can also be beneficial to cultural resources. Carefully coordinated application of fire and mechanical treatments can be used to reduce threats to archeological sites, historic structures, and cultural landscapes. For example, removing heavy fuels from the surface of an archeological site prior to a prescribed burn can safeguard on-site resources against direct and indirect effects, while the burn will reduce the possibility of catastrophic wildfire and associated impacts (e.g., high intensity fire, suppression activities).

Ethnographic resources can also be enhanced through the use of fire management practices. For

example, yields and quality of certain plant and animal foods and raw material are improved by burning.

Properly conducted, and following the mitigation and monitoring procedures identified previously in the document, prescribed fire and mechanical thinning projects have the highest potential to yield beneficial impacts. Wildland fire for resource benefit can yield some potential benefits, although drawbacks include potential lack of resource inventory and less control of fire behavior. Finally, wildfires have the least benefit to cultural resources due to high intensity fire behavior and suppression impacts.

Cumulative Impacts
Overtime, as more acres are burned within the recreation area, and in adjoining areas, in accordance with the fire management strategies, more surveys for cultural resources would be completed. More would be known about cultural sites, and more areas would be protected as they would be designated as suppression zones.

Conclusion
Unknown cultural resources could be burned and irretrievable under this alternative. This alternative would result in moderate to major impacts to cultural resources. However, surveys for cultural resources would continue within the recreation area, and significant cultural resources would be identified and protected by creating suppression zones.

With mitigation and protective measures, including pre-burn surveys, on-site monitors for cultural resources, and the designation of suppression zones around known cultural resources, the level of this impact is reduced to moderate.

This alternative would not result in impairment to cultural resources as it would not result in the loss, destruction, or degradation of a cultural property, resource, or value to the point that it negatively affects the park's purpose and visitor experience.

PARK OPERATIONS, PUBLIC HEALTH, AND SAFETY

Impacts from Alternative A: Continue Current Management

Fire management staff is currently available during the primary fire season within the recreation area to support the continued fire management program. Fire crews and additional staff from other areas could be requested if necessary for suppression or wildland fire use activities. Crews are currently available for non-native plant control in riparian areas.

Impacts Associated with Suppression Activities: Areas would be closed to public use during suppression activities, therefore, there would be no impacts to public health and safety.

The use of chain saws and other power equipment could create unsafe conditions to fire management crews. However, crews would be trained and protective gear would be worn, and while there is always a risk when using this type of equipment, training and proper use would reduce the potential for injury.

Impacts Associated with Wildland Fire Use: Areas would be closed to public use during wildland fire activities, therefore, there would be no direct impacts to public health and safety.

Smoke exposure can create potential health hazards. When dispersed properly, smoke from fires does not threaten human health. Mitigation, including notifying the public of elevated pollution concentrations, warning sensitive persons to minimize their exposure, and complying with the air quality criteria should reduce impacts to the public.

However, high smoke concentrations at the fire line can expose firefighters to components that can cause potential health hazards, including acrolein, benzene, carbon monoxide, formaldehyde, and respiratory particulates. Studies have found that one to ten percent of firefighters may be exposed to respiratory irritants and carbon monoxide above the limits recommended by advisory organizations. Less than 5 percent of firefighters may exceed the federal exposure limits for these substances. Certain tasks near the fire where there is intense exposure to smoke may exceed recommended short-term exposure limits, and high winds can lead to excessive smoke exposure. Exposure to smoke can create minor to major impacts to firefighter health and safety depending on conditions, firefighter health, and time spent working on high-risk tasks in high-risk areas.

As more information is available to managers, and technology is developed to protect firefighters from exposure to smoke hazards, and guidelines are developed, these guidelines will be adopted at Lake Mead NRA. Currently, to protect firefighters from exposure to dangerous levels of smoke, crews are rotated in and out of the smoke areas. This is standard practice for firefighting.

Impacts associated with Non-Native Plant Control in Riparian Areas: Exposure to smoke would have the same impacts as described above. Prescribed fires in riparian areas are generally small in size and short-term in duration. Ignition occurs only when conditions are optimal, and wind conditions and smoke dispersal is evaluated as part of those conditions. Therefore, exposure to smoke and the hazards associated with smoke is reduced, and could create minor to moderate impacts to fire fighter safety and health.

Cumulative Impacts

Part of the evaluation to determine if wildland fire use is appropriate is to assess what is occurring on a regional level. If fires are occurring nearby, and wildland fire use activities could impact the air quality of the same area, appropriate suppression methods would be utilized. Therefore, smoke from wildland fire use would not contribute to the overall exposure levels in the region.

Conclusion

There would be no impact to park operations as staff currently exists to manage the suppression, wildland fire use, and non-native treatment programs. Exposure to smoke can create minor to major impacts to firefighter health and safety depending on conditions, firefighter health, and time spent working on high-risk tasks in high-risk areas. During non-native vegetative treatment activities, exposure to smoke and the hazards associated with smoke is reduced by mitigation, and could create minor to moderate impacts to fire fighter safety and health.

Impacts from Alternative B: Full Suppression
Fire management staff is currently available during the primary fire season within the recreation area to support a full suppression program. Fire crews and additional staff from other areas could be requested if necessary for suppression activities. Crews are currently available for non-native plant control in riparian areas.

Smoke exposure during the suppression activities would be the same as described under Alternative A. However, over the long-term, as fuel loading increases on the Shivwits Plateau, the probability of a large, difficult to manage wildfire increases. If this type of fire occurs, and large acreages are burned, increased impacts from smoke exposure could occur to the public and to firefighters.

Cumulative Impacts
With a full suppression program in place, it is likely that fuel loadings would increase on the Shivwit Plateau portion of the recreation area. Over time, this would increase the probability of a large, difficult to suppress, wildfire. If this occurs, the wildfire could spread to outside of recreation area boundaries onto adjacent lands. Smoke exposure could not be mitigated if the fire burned out of control, therefore, moderate to major impacts could occur to the public and to firefighters.

Conclusion
There would be no impact to park operations. Exposure to smoke can create minor to major adverse impacts to firefighter health and safety depending on conditions, firefighter health, and time spent working on high-risk tasks in high-risk areas. If a high intensity fire occurs, and crews are unable to control its spread, exposure levels to smoke could increase and create moderate to major adverse impacts to the public and fire crews. During non-native vegetative treatment activities, exposure to smoke and the hazards associated with smoke is reduced by mitigation, and could create minor to moderate impacts to fire fighter safety and health.

Impacts from Alternative C: Combination of Wildland Fire Use and Suppression

Impacts from this alternative to park operations, public health, and safety would be the same as described under Alternative A. There could be more impacts from smoke around the interface and developed areas during treatment activities. Mitigation including burning during optimal conditions and public notification would reduce these impacts. Therefore, only minor impacts from smoke exposure would result from treatment activities.

Cumulative Impacts
Cumulative impacts would be the same as described under Alternative A.

Conclusion
There would be no impact to park operations as staff currently exists to manage the suppression, wildland fire use, and non-native treatment programs. Exposure to smoke can create minor to major impacts to firefighter health and safety depending on conditions, firefighter health, and time spent working on high-risk tasks in high-risk areas. During non-native vegetative treatment

activities, exposure to smoke and the hazards associated with smoke is reduced by mitigation, and could create minor to moderate impacts to fire fighter safety and health.

WILDERNESS AND LAND USE

Impacts from Alternative A: Continue Current Management

Impacts Associated with Suppression Activities: Suppression activities would occur in proposed and proposed potential wilderness areas in the low desert portions of the recreation area. A minimum tool analysis would occur prior to determining the appropriate suppression activities. Generally, crews with hand tools are utilized in the low desert portion of the recreation area. Small, scratch lines, existing roads, and natural barriers are utilized for firelines. Vehicles are not permitted off approved roads, which are outside wilderness areas. Heavy equipment is not authorized except in rare and unusual situations, and only with superintendent's approval. Some aerial support could be utilized, creating temporary impacts to the wilderness resource from noise and the use of low-level aircraft. Visitor access would be restricted during fire activities.

There would be no permanent impact to the wilderness character due to suppression activities. Suppression would protect existing right-of-way corridors.

Impacts Associated with Wildland Fire Use: Wildland fire use would occur on the Shivwits Plateau region of the recreation area. This would allow for the natural process to be restored in the region, and could lead to improved wilderness character. Mitigation would further protect the wilderness character of the area. No right-of-way corridors currently exist in the Shivwits region, therefore, there would be no impact from wildland fire use.

Impacts associated with Non-Native Plant Control in Riparian Areas: Temporary impacts to the wilderness character could occur from non-native plant control in riparian areas. The use of chainsaws, prescribed fire, and herbicide have proven effective and have been determined by land managers to be the minimum tools for non-native plant control in these areas. The treatment activities would create temporary negative impacts to those individuals seeking a wilderness experience during treatment periods. Noise from chainsaw use could temporarily impact visitors in the area around the treatment areas. Mitigation, including advance public notification, could reduce these impacts. In the long-term, as riparian areas are restored to their native conditions, the wilderness character would improve. There would be no permanent negative impact to the wilderness character as a result of these activities.

No right-of-way corridors exist in treatment areas, therefore, there would be no impact.

Cumulative Impacts:
No cumulative impacts would occur to wilderness areas.

Conclusion:
Minor, short-term impacts would occur to the wilderness area due to treatment activities. However, the character of the wilderness would not be permanently impacted and no impairment

to wilderness would occur as a result of the impacts associated with this alternative. No impacts to right-of-way corridors would occur.

Impacts from Alternative B: Full Suppression
Full suppression in the low desert regions of Lake Mead NRA would have the same impacts as described under Alternative A. Full suppression on the Shivwits Plateau portion of the recreation area could lead to increased use of heavy equipment and aerial support, depending on the intensity of the fire. The natural fire regime would not be restored. In addition, with a full suppression policy, fuel loading increases over time, as does the probability of a high intensity, difficult to contain wildfire. A wildfire like this could burn large acreages, and could spread onto adjacent lands, impacting large portions of proposed, proposed potential, or designated wilderness areas. Recovery would take time and would depend on the intensity of the wildfire, the acreage, seed sources, and rainfall.

Cumulative Impacts
Under this alternative, the natural process would not be restored on the Shivwits Plateau region of the recreation area. A large, difficult to contain wildfire could occur as a result of increased fuel loading from a full suppression policy. This type of scenario has existed in many regions of the Southwest, and has resulted in large, intense wildfires, and thousands of acres of burned areas, resulting in temporary closures of some wilderness areas. Without effective management and restoring natural conditions on the Shivwits Plateau, this is likely to occur in this region.

Conclusion
Full suppression in the low desert portions of the recreation area would protect these areas and would not permanently impact the character of the wilderness resource. Full suppression on the Shivwits Plateau region of the recreation area would not allow the natural processes to reestablish in the region. It could lead to a large, intense wildfire that could burn many acres of wilderness resources. This could result in temporary closures during and after the fire, and the use of heavy equipment and aerial support to control the spread of the fire. Recovery would take place over time, however, without restoring the natural processes, the scenario is likely to occur periodically through time. Ongoing vegetative treatment and hazard fuel reduction activities would reduce this impact below levels that constitute impairment to wilderness resources. There would be no impact to right-of-way corridors.

Impacts from Alternative C: Combination of Wildland Fire Use and Suppression
The impacts of this alternative to land use would be the same as described under Alternative A.

Cumulative Impacts
The cumulative impacts of this alternative would be the same as described under Alternative A.

Conclusion
Minor, short-term impacts would occur to the wilderness area due to treatment activities. However, the character of the wilderness would not be permanently impacted and no impairment to wilderness would occur as a result of the impacts associated with this alternative. No impacts to right-of-way corridors would occur.

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SECTION V: CONSULTATION AND COORDINATION

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Bureau of Land Management, Arizona Strip District
U.S. Department of Agriculture, Natural Resource Conservation Service
Grand Canyon National Park
Grand Canyon-Parashant National Monument
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SECTION VII. LIST OF ACRONYMS AND DEFINITIONS

Acronyms

ACHP – Advisory Council on Historic Preservation
ADEQ – Arizona Department of Environmental Quality
ARPA – Archeological Resources Protection Act
ASMIS - Archeological Sites Management Inventory System
BLM – Bureau of Land Management
BOR – Bureau of Reclamation
BTUs – British Thermal Units
CCMSHCP – Clark County Multiple Species Habitat Conservation Plan
CEQ – Council of Environment Quality
CFR – Code of Federal Regulations
DO- Director's Order
DOI/USDI – Department of the Interior
EO – Executive Order
EPA – Environmental Protection Agency
FMP – Fire Management Plan
FMU – Fire Management Unit
FONSI – Finding of No Significant Impact
GCPNM – Grand Canyon-Parashant National Monument
GIS – Geographic Information System
GMP – General Management Plan
HABS/HAER – Historic American Buildings Survey/Historic American Engineering Record
HRS – Historic Resources Study
IC – Incident Commander
LCS – List of Classified Structures
MIST – Minimum Impact Suppression Techniques
MMA – Maximum Management Area
NAAQS – National Ambient Air Quality Standards
NEPA – National Environmental Policy Act
NHPA – National Historic Preservation Act
NM – National Monument
NNL – National Natural Landmark
NP – National Park
NPS – National Park Service
NRA – National Recreation Area
NRCS – Natural Resource Conservation Service
PPE – Personal Protective Equipment
$PM_{2.5}$ - Particulates with diameters of 2.5 micrometers or less
PM_{10} - Particulates with diameters of 10 micrometers or less
RM – Reference Manual
RMP – Resource Management Plan
TCP – Traditional Cultural Property
USDA – United States Department of Agriculture

USGS – United States Geological Service
WACC – Western Archeological and Conservation Center
WFRBs – Wildland Fire for Resource Benefits

Definitions

Appropriate Management Response - Specific actions taken in response to a wildland fire to implement protection and fire use objectives.

Confinement - Confinement is the strategy employed in appropriate management responses where a fire perimeter is managed by a combination of direct and indirect actions and use of natural topographic features, fuel, and weather factors.

Crown Fire - A fire spreading through the crowns of trees.

Cultural Resources - These resources include archeological sites, ethnographic information, cultural landscapes and historic structures.

Decision Criteria Checklist (Initial Go/No-Go Decision) – A set of standards evaluation criteria to determine if the current wildland fire meets criteria to be managed for resource benefits. The completion of these criteria will lead to a decision to "Go/Not-Go" with management of the fire for resource benefits.
The five standard decision criteria in the decision checklist are:

- Is there a threat to life, property, or resources that cannot be mitigated?
- Are potential effects on cultural and natural resources outside the range of acceptable effects?
- Are relative risk indicators and/or risk assessment results unacceptable to the appropriate Agency Administrator?
- Is there other proximate fire activity that limits or precludes successful management of this fire?
- Are there other Agency Administrator issues that preclude wildland fire use?

A "yes" response to any element on the checklist indicates that the appropriate management response should be suppression-oriented. The Recommended Response Action documents the Go/No-Go recommendation. The superintendent (or other designated individual) must sign the Decision Criteria Checklist.

Emergency Fire Rehabilitation/Burned Area Emergency Rehabilitation (EFR/BAER) - Planned actions taken during and after a wildland fire to stabilize and prevent unacceptable resource degradation or to minimize threats to life or property resulting from the fire.

Emergency Spill Response - The response to any amount of a regulated waste or hazardous material that is spilled to the environment (air, land, surface waters, ground waters) that may detrimentally affect health, the environment, or property.

Fire Resources - Fire resources are the people and equipment needed to manage or suppress wildland fires. These resources include, but are not limited to: overhead teams, firefighters, resource advisors, engines, helicopters, and retardant aircraft.

Fire Frequency - A general term referring to the recurrence of fire in a given area over time.

Fire Management Unit (FMU) - any land management area definable by objectives, topographic features, access, values-to-be-protected, political boundaries, fuel types, or major fire regimes, etc., that sets it apart from management characteristics of an adjacent unit. FMUs are delineated in Fire Management Plans (FMP). These units may have dominant management objectives and pre-selected strategies assigned to accomplish these objectives.

Fire Regime - A generalized description of the role fire plays in an ecosystem. It is characterized by fire frequency, predictability, seasonality, intensity, duration, scale (patch size), as well as regularity or variability.

Fire Return Interval - The number of years between two successive fire events in a given area.

Fire Suppression Activity Damage - Emergency actions taken to repair or rehabilitate damage to lands, resources, and facilities directly attributable to the wildland fire suppression effort or activities.

Fireline Intensity - This is the amount of heat released per unit time per unit length of fire line.

Hazard Fuels - Excessive live and/or dead wildland fuel accumulations (either natural or created) having the potential to for the occurrence of uncharacteristically intense wildland fire.

Hazard Fuel Reduction - Hazard fuel reduction projects remove excessive live or dead fuel to protect life and property, including communities at risk and municipal watersheds; natural resources, including critical native plant communities and their processes, and threatened and endangered species; and important cultural resources. These treatments, a variety of fire and non-fire techniques, include, but are not limited to, prescribed fire and wildland fire use, mechanical, chemical, biological, and manual methods.

Holding Actions - planned actions required to achieve wildland and prescribed fire management objectives. These actions have specific implementation timeframes for fire use actions but can have less sensitive implementation demands for suppression actions. For wildland fires managed for resource benefits, an MMA may not be totally naturally defensible. Specific holding actions are developed to preclude fire from exceeding the MMA. For prescribed fires, these actions are developed to restrict the fire inside the planned burn unit. For suppression actions, holding actions may be implemented to prohibit the fire from crossing containment boundaries. These actions may be implemented as firelines are established to limit the spread of fire.

Initial Attack - An aggressive suppression action consistent with firefighter and public safety and values to be protected.

List of Classified Structures- The LCS is a computerized, evaluated inventory of all historic and prehistoric structures with historical, architectural, or engineering significance in which NPS has or plans to acquire any legal interest. Included are structures that individually meet the criteria of the National Register or are contributing elements of sites and districts that meet the National Register criteria. Also included are other structures - moved, reconstructed, and commemorative structures, and structures achieving significance within the last 50 years - that are managed as cultural resources because of decisions reached through the planning process. The LCS assists park managers in planning, programming, and recording decisions of appropriate treatment.

Manual/ Mechanical Treatment - Manual treatment is the use of hand-operated power tools and handtools to cut, clear or prune herbaceous and woody species. It is a method of reducing hazardous accumulations of wildland fuels, and is often used to create defensible space near structures.

Minimum Impact Suppression Techniques (MIST) Guidelines that assist fire personnel in the choice of procedures, tools, and equipment used in fire suppression and post-fire rehabilitation. These techniques reduce soil disturbance, impact to water quality, noise disturbance, intrusions in the wilderness, and cutting or trampling of vegetation.

Minimum Requirement Process - A method for assessing whether a proposed wilderness-related administrative activity is necessary and to identify the minimum tool for effectively carrying out the activity.

Natural Resources - These resources include vegetation and wildlife (both terrestrial and aquatic), plus atmospheric, geologic and hydrologic features. The wilderness character of the park can be considered a natural resource or a social resource.

Maximum Manageable Area (MMA) - MMA defines the firm limits of management capability to accommodate the social, political, and resource impacts of a wildland fire. Once established as part of an approved plan, the general impact area is fixed and not subject to change. MMAs can be developed as part of the FMP and described as a FMA. They can also be developed as part of the planning and implementation of management actions after a fire has ignited. If they are developed after the ignition, their definition will occur during the Wildland Fire Implementation Plan Stage III process. In the event a fire occurs in a pre-planned MMA or FMA and the local unit determines that this MMA is not the best-suited alternative for the present conditions, a new MMA can be developed as part of the Stage III process. Once this occurs, the Stage III MMA becomes the firm limits of the fire and is fixed.

Mitigation Actions - Mitigation actions are considered to be those on-the-ground activities that will serve to increase the defensibility of the MMA; check, direct, or delay the spread of fire; and minimize threats to life, property, and resources. Mitigation actions may include mechanical and physical non-fire tasks, specific fire applications, and limited suppression actions. These actions will be used to construct firelines, reduce excesssive fuel concentrations, reduce vertical fuel continuity, create fuel breaks or barriers around critical or sensitive sites or resources, create "blacklines" through controlled burnouts, and to limit fire spread and behavior.

Preparedness - Activities that lead to a safe, efficient and cost effective fire management program in support of land and resource management objectives through appropriate planning and coordination. This term replaces presuppression.

Prescribed Fire - Any fire ignited by management actions to meet specific objectives. A written, approved prescribed fire plan must exist, and NEPA requirements must be met, prior to ignition. This term replaces management ignited prescribed fire.

Prescribed Fire Plan - a plan required for each fire application ignited by managers. It must be prepared by qualified personnel and approved by the appropriate Agency Administrator prior to implementation. Each plan will follow specific agency direction and must include critical elements described in agency manuals. Formats for plan development vary among agencies, although content is the same.

Prescription - Measurable criteria which define conditions under which a prescribed fire may be ignited, guide selection of appropriate management responses, and indicate other required actions. Prescription criteria may include safety, economic, public health, environmental, geographic, administrative, social or legal considerations.

Slash Pile Burning - Burning of vegetative material that has been concentrated by manual or mechanical methods in a wildland fuel or vegetative treatment environment.

Wildland and Prescribed Fire Complexity Analysis – The formal process to determine the full complexity rating for wildland and prescribed fires. It utilizes 12 variables having numerically weighted importance combined with user identified complexity values.

Wildland Fire - Any non-structure fire, other than prescribed fire, that occurs in the wildland. This term encompasses fires previously called both wildfires and prescribed natural fires.

Wildland Fire Situation Analysis (WFSA) - A decision-making process that evaluates alternative management strategies against selected safety, environmental, social, economic, political, and resource management objectives.

Wildland Fire Suppression - an appropriate management response to wildland fire that results in curtailment of fire spread and eliminates all identified threats from the particular fire. All wildland fire suppression activities provide for firefighter and public safety as the highest consideration, but minimize loss of resource values, economic expenditures, and/or the use of critical firefighting resources.

Wildland Fire Use - the management of naturally-ignited wildland fires to accomplish specific pre-stated resource management objectives in pre-defined geographic areas outlined in Fire Management Plans. Operational management is described in the Wildland Fire Implementation Plan (WFIP). Wildland fire use is not to be confused with "fire use," which is a broader term encompassing more than just wildland fires (see definition below):

Fire Use - the combination of wildland fire use and prescribed fire application to meet resource objectives

Wildland-Urban Interface - The Wildland-Urban Interface is the area where homes and structures meet the natural environment of forests and wildlands.

APPENDIX A

FINDING OF NO SIGNIFICANT IMPACT
FOR THE
VEGETATION TREATMENT AND HAZARD FUEL REDUCTION PROGRAM
2002-2006

Shivwits Plateau Area
Lake Mead National Recreation Area
Grand Canyon-Parashant National Monument

INTRODUCTION

The National Park Service (NPS), Lake Mead National Recreation Area (NRA), in coordination with Grand Canyon-Parashant National Monument (GCPNM), has prepared an environmental assessment (EA) that evaluates four alternatives for implementing an adaptive management program for vegetation treatment and hazard fuel reduction on the Shivwits Plateau, within Lake Mead NRA and GCPNM.

The Shivwits Plateau portion of Lake Mead NRA is an extremely remote area within the Arizona Strip located on the northwest rim of the Grand Canyon. It is 90 miles south of St. George, Utah. Bordering the north side of the recreation area boundary is primarily Bureau of Land Management (BLM) administered lands, while Grand Canyon National Park is adjacent on the south and east. It is within the boundaries of GCPNM.

Various studies have shown that certain vegetation communities, including sagebrush, pinyon-juniper, and ponderosa pine communities, have been negatively altered due to fire suppression activities during the last 50 years. Biologists and resource specialists have determined that this is true of the vegetation communities on the Shivwits Plateau. Since 1992, an experimental prescribed fire program has been ongoing on the Shivwits Plateau. The objectives of this program were to evaluate the effectiveness of fire in restoring native vegetation and decreasing hazard fuels. The success of the program is being monitored through fire effects monitoring, field studies, and photo points. The program has shown mixed results so far. Additional experimental treatments and techniques for vegetation management and fuel reduction have been proposed and are evaluated under the EA.

The EA evaluates the effects of the Alternative A, the no action alternative, no vegetation treatment or prescribed fires in the region; Alternative B, vegetation treatment through the continuation of an experimental prescribed fire program; Alternative C, vegetation treatment through an experimental program using a combination of methods; and, Alternative D, vegetation treatment utilizing an experimental chemical treatment and prescribed fire program. The NPS decision is to select Alternative C, the Preferred Alternative, which allows the implementation of an experimental program using a combination of methods.

PURPOSE AND NEED

The primary purpose of the adaptive management program is to attempt to restore fire as a natural process in the Shivwits Plateau region of the recreation area. This would be accomplished by restoring fuel loadings and ecosystem structure in vegetative communities that have been altered by past management activities. The overall goals of the program are to increase biodiversity and promote the establishment of native grasses and forbs to aid in preventing soil erosion and increase wildlife forage; and, to restore wildlife habitat and increase potential habitat for sensitive species. The program would continue to be refined based on research, fire effects monitoring, and overall accomplishment of program goals.

ALTERNATIVE CONSIDERED

The EA evaluates four alternatives: Alternative A, the no action alternative, no treatment or prescribed fires in the region; Alternative B, vegetation treatment through the continuation of an experimental prescribed fire program; Alternative C, vegetation treatment through an experimental program using a

combination of methods; and, Alternative D, vegetation treatment utilizing an experimental chemical treatment and prescribed fire program. Several other alternatives were initially considered but were not fully developed or evaluated for various reasons, as described in the EA.

Management-Preferred Alternative
The Management-Preferred Alternative (Alternative C) includes implementing an adaptive program using a combination of methods. Restoration thinning and prescribed fire will be the primary methods of treatment. Restoration thinning will be used in selected areas to thin tree stands and reduce tree density. Mechanical treatment will be utilized in selected areas for restoration thinning, and for site preparation for burns. Light-handed mechanical treatment will be used where appropriate. The minimum tools have been determined to be chainsaws, scrapers, rakes, and leaf blowers. Around roadways in areas greater than 250 acres, there is the potential to use a tree shearer and other associated tree removal equipment.

Prescribed burning will be utilized, either in conjunction with restoration thinning and mechanical preparation, or as the primary method of treatment, depending on the treatment unit. Each treatment unit will have a specific plan, with designated fire effects monitoring plots, if appropriate. Treatment plans will be approved individually by the Superintendent prior to the implementation of any burn.

A small-scale experimental herbicide treatment will be initiated in a pinyon-juniper unit under this alternative. Four 20-acre plots will be treated using the low impact thinline basal spray treatment. A liquid herbicide (Tordon 22K) will be applied by ground crews using backpack sprayers. At least 50 percent of the non-old growth age category of pinyon and juniper trees will be treated and left standing. No follow-up cutting or prescribed fire will be planned for this unit. Monitoring plots will be installed to determine the effectiveness and monitor the effects of this treatment method.

Other Alternatives Considered
Under the No Action Alternative (Alternative A), there would be no treatment of vegetation. Neither prescribed fires, mechanical treatment, or herbicide treatment would be utilized.

Alternative B includes implementing an adaptive management program involving prescribed fires that would be completed for the purpose of resource benefit during the 5-year period starting in 2004 and ending in 2008. Each prescribed fire would have a specific plan, with designated fire effects monitoring plots, if appropriate. Fire plans would be approved individually by the Superintendent prior to the implementation of any burn. There would be no mechanical treatment utilized under this alternative.

Alternative D includes implementing an adaptive management program that utilizes chemical treatments in an attempt to meet management objectives. Herbicides would be applied to designated units by a variety of methods, depending on the management objectives of each unit. The follow up treatment in each unit would vary. Selected units would have no follow-up treatment, others would have post-burning, and some units that are located near roadways, would have debris hauled from the site. This alternative, though evaluated in the EA, was discarded due to the lack of available information and the uncertainty over the effects of chemical treatment on the ecosystem. Instead, as described under the preferred alternative, a small-scale chemical treatment plot will be established to monitor the long-term effects of chemical treatment on the environment and its feasibility for future use. Any future use of herbicide beyond the described experimental treatment would be evaluated in a separate compliance document.

ENVIRONMENTALLY PREFERRED ALTERNATIVE
An alternative must meet the following criteria to be considered an environmentally preferred alternative:

1. Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
2. Ensure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings;
3. Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences;
4. Preserve important historic, cultural, and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice;
5. Achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities; and
6. Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Alternative C is the environmentally preferable alternative. Overall, it would best meet the requirements of Section 101 of the National Environmental Policy Act (NEPA) as it would help enhance the quality of the vegetative communities on the Shivwits Plateau. It would preserve important historic, cultural, and natural aspects of our national heritage through the restoration of the natural process on the Shivwits Plateau. If the goals of the adaptive management program are met, alternative C would enhance the quality of the renewable resources, primarily the forest resources, in the area.

MITIGATION AND MONITORING METHODS

Mitigation measures are specific actions designed to minimize, reduce, or eliminate impacts of the Preferred Alternative, and to protect recreation area resources and visitors. Monitoring activities are actions to be implemented before, during or following the treatment activities. These measures are assumed in the analysis of environmental consequences for the Preferred Alternative.

Soils and Vegetation

Prior to treatment activities, the NPS will conduct rare and non-native plant surveys in each treatment unit. Areas with rare plants will be mapped and designated as non-treatment areas. Areas with heavy populations of non-native plants, including cheat grass, will be mapped and these areas and adjacent areas would be designated as non-treatment areas.

Seeding of native species will occur in selected areas to assist with the recovery of treatment areas. Seeding guidelines and methods as described in the EA will be adopted. Follow-up monitoring will occur on an annual basis to assess the success of the seeding program and to determine if non-native species are present. If necessary, non-native plant control will be considered as a follow-up action.

To protect snags, old growth trees, large logs, and rare plant habitat, crews will construct control lines around these areas, and these areas will be designated as non-treatment zones.

Thinning will occur in portions of the ponderosa pine treatment units and only postsettlement trees will be designated for thinning. Resource specialists will determine which trees will be cut, and if removal of cut trees is necessary to protect from hazard fuel buildup.

Fire lines and soil scars will be restored after the completion of treatment activities.

Wildlife

Maps of existing nesting sites and habitat will be used to designate non-treatment zones. Surveys by wildlife biologists will be conducted in each unit prior to any treatment activities to locate potential nesting cavities. All areas where nesting sites are found will be mapped and designated as non-treatment

zones. These areas will be further protected by the construction of control lines where determined necessary by wildlife biologists and fire management staff.

Sensitive, Threatened, and Endangered Species
No threatened or endangered species have been found in the project area, though potential habitat has been identified by park biologists. Park biologists, in consultation with the U.S. Fish and Wildlife Service, recommend the following mitigation measures be adopted to ensure a finding of no effect, or not likely to adversely affect.

Maps of existing and potential habitat for sensitive, threatened, and endangered species were consulted in the development of the EA and existing and potential habitat were designated as non-treatment zones. Surveys will continue in the region as directed by the NPS and BLM wildlife biologists. If more potential habitat is designated, these areas will also be designated as non-treatment zones.

Surveys were initiated for Mexican spotted owls and northern goshawk in 2002. The potential Mexican spotted owl habitat in the Shivwits region is classified by NPS wildlife biologists as dispersal areas or migrating habitat, rather than breeding areas. Preliminary surveys by NPS wildlife biologists found no Mexican spotted owls. Follow-up two-year surveys started in the summer of 2002 in accordance with U.S. Fish and Wildlife Service protocol. The survey areas focused on ponderosa pine stands, slot canyons, and riparian zones. No Mexican spotted owls were found during the first year of the surveys. If Mexican spotted owls are found during future surveys, or at any time, all operations in that area will be halted and further consultations with the U.S. Fish and Wildlife Service will be initiated.

Northern goshawk nests have been recorded adjacent to the Shivwits area on BLM administred lands. Northern goshawks are considered a sensitive species and a species of special concern at Lake Mead NRA. Surveys for northern goshawks were conducted summer 2002, in all areas where fire activities are planned. One nest site was discovered. No treatment activities will occur in the areas where goshawks are nesting. If additional goshawks are discovered in a treatment area, fire managers will work with the wildlife biologists to determine an acceptable course of action, which may include delaying the treatment schedule or altering the location of the treatment.

It has been determined that the preferred alternative would have no effect on the bald eagle, since it is a transitory visitor to the area during migration.

Potential habitat for the California condor exists in the region, and biologists tracking the condors have reported them nearby. If condors are found inhabiting portions of the Shivwits region, those areas would be designated as non-treatment zones. The USFWS will be consulted to determine the appropriate size of the non-treatment zone. In addition, the following mitigation measures will be adopted specifically for the protection of the California condor.

- Prior to burn activities, biologists from the Peregrine Fund condor program will be contacted to check if condors are currently in or near areas of the Shivwits Plateau.

- If condors occur in the action area during mechanical treatment operations, activities within 300 feet of the bird will cease until it leaves on its own or until techniques are employed by permitted personnel which result in the individual leaving the area.

- All on-site personnel will be informed to avoid interacting with condors and to immediately contact the NPS wildlife biologist or resource staff so they can inform the U.S. Fish and Wildlife Service or Peregrine Fund personnel.

- The Lake Mead NRA Best Management Practices Manual will be followed at all times for fluid leakage and spills.

- Open water sources such as "pumpkin" inflatable water storage tanks will be covered when not in use.

- If condors are located near the project area, weather conditions will be evaluated by Prescribed Fire Specialists and Resource Advisors to determine the potential for impacts from smoke on the condors. Prescribed fire will be avoided if weather conditions increase the impacts of smoke on condors.

Peregrine falcons inhabit and utilize cliff portions of the Shivwits Plateau and the Grand Canyon. While this species is no longer listed as threatened or endangered, it is still considered a species of concern in the recreation area. The peregrine falcon primarily uses cliff sites for nesting and rarely uses old tree nests or cavities. As all units will be surveyed for nests, and all nesting sites will be protected and zoned for non-treatment, the sites will be protected. In addition, the cliff areas are not within the designated treatment units.

Monitoring will continue for other sensitive wildlife species, including bats. Rare plant mitigation is discussed in the Soils and Vegetation section.

Riparian Areas
Riparian areas will not be included in the treatment units and will be protected through the construction of control lines and suppression activities.

Potential and Proposed Potential Wilderness Areas
Light hand suppress techniques will be employed for all treatment activities. Each treatment unit will be evaluated on a case-by-case basis to determine the appropriate tool. The appropriate tool will depend on the acreage of the treatment area, the location of the unit, the resource goals for that unit, the timing of the treatment, and the staff available for the treatment.

Bulldozers will not be used in treatment activities. The only constructed fire line used will be handlines. Treatment units are designed to make use of natural and unnatural fuel breaks, so fire lines will not have to be constructed for each unit. Where fire lines construction is necessary, fire lines and soil scars will be restored after the completion of management activities.

Grazing
Grazing will be temporarily restricted in units when treatment activities are taking place. The restriction will remain in place until the time that park biologists determine that grazing can be reinstated.

Air Quality
The Arizona Department of Environmental Quality (ADEQ) smoke management procedures, recommendations, and requirements will be followed during all phases of the prescribed fire. A burn plan will be submitted to ADEQ for approval upon designation of a prescribed fire, followed by a daily burn request and accomplishment report. Monitoring of smoke will be a high priority that will include volume, dispersal, mixing heights, atmospheric conditions, and any other smoke concerns.

Cultural Resources
Archeological clearances will be completed prior to the initiation of any treatment activities. Fire suppression zones will be designated around known cultural and historic resources that could be adversely affected by fire. A cultural resource specialist will be on site to monitor prescribed fires for adverse impacts to cultural resources and appropriate suppression activities will take place if a

determination is made that the fire will adversely impact cultural resources. Suppression activities will include fire crews being dispatched to construct control lines around known cultural and historic resources, removal of downed logs and other heavy fuel sources from sites, and removal of hazardous trees from around structures and ruins. The sites that are identified in the archeological clearance as being susceptible to erosion after burning will be monitored.

Known cultural areas will not be treated and if previously unknown cultural resources are discovered, treatment activities will be discontinued in the area.

Visitor Use
Visitors will be informed of treatment activities through signs, press releases, and information provided on the NPS website and at area visitor centers. Visitors will be directed to alternative areas during treatment activities.

Safety
Treatment and fire crews will wear the required personal protective equipment.

Each burn plan will contain holding and wildland fire transition plans describing appropriate actions in the event the prescription is exceeded. All burn plans will address the need for alerting park neighbors and appropriate public officials to the objectives and timing of the planned treatment and designate a specific individual as responsible for making these notifications. No prescribed fires will be ignited unless the responsible personnel determine that optimum conditions to prevent the fire from exceeding the prescription exist.

Fire suppression zones will be designated around administrative structures, residential area, and recreational sites. Hazard fuel reduction will occur, if determined necessary on a case-by-case basis, around residential, historic, and administrative structures.

The policies for handling an escaped prescribed fire as contained in NPS Reference Manual 18 and existing interagency agreements will be followed.

Recreation Area Operations
Fire effects monitoring will be accomplished in selected plots to evaluate the degree to which objectives are accomplished and to ensure that undesired effects are not occurring.

The following matrix summarizes the mitigation measures required for the Preferred Alternative.

Impact Topic	Mitigation Required under the Preferred Alternative (Alternative C)	Responsible Party
Vegetation and Soils, including Rare Plants	Prior to treatment activities, the NPS will conduct rare and non-native plant surveys in each treatment unit. Areas with rare plants will be mapped and designated as non-treatment areas. Areas with heavy populations of non-native plants, including cheat grass, will be mapped and these areas and adjacent areas would be designated as non-treatment areas. Seeding of native species will occur in selected areas to assist with the recovery of treatment areas. Seeding guidelines and methods as described in the EA will be adopted. Follow-up monitoring will occur on an annual basis to assess the success of the seeding program and to determine if non-native species are present. If necessary, non-native plant control will be considered as a follow-up action. To protect snags, old growth trees, large logs, and rare plant habitat, crews will construct control lines around these areas, and these areas will be designated as non-treatment zones. Thinning will occur in portions of the ponderosa pine treatment units and only postsettlement trees will be designated for thinning. Resource specialists will determine which trees will be cut, and if removal of cut trees is necessary to protect from hazard fuel buildup. Fire lines and soil scars will be restored after the completion of treatment activities.	Lake Mead NRA Botanist and Prescribed Fire Specialist
Wildlife	Maps of existing nesting sites and habitat will be used to designate non-treatment zones. Surveys by wildlife biologists will be conducted in each unit prior to any treatment activities to locate potential nesting cavities. All areas where nesting sites are found will be mapped and designated as non-treatment zones. These areas will be further protected by the construction of control lines where determined necessary by wildlife biologists and fire management staff.	Lake Mead NRA Wildlife Biologist and Prescribed Fire Specialist
Sensitive, Threatened, and Endangered Species	Maps of existing and potential habitat for sensitive, threatened, and endangered species were consulted in the development of the EA and these areas were designated as non-treatment zones. Surveys will continue in the area as directed by the NPS and BLM wildlife biologists. If more potential habitat is designated, these areas will also be designated as non-treatment zones. Surveys will be conducted for Mexican spotted owls and Northern goshawk in accordance with U.S. Fish and Wildlife Service	Lake Mead NRA Wildlife Biologist

Impact Topic	Mitigation Required under the Preferred Alternative (Alternative C)	Responsible Party
	protocol. The survey areas for owls will be focused on ponderosa pine stands, slot canyons, and riparian zones. If Mexican spotted owls are found, all operations in that area will be halted and further consultations with the U.S. Fish and Wildlife Service will be initiated. Surveys for northern goshawks will continue to be conducted in all areas in which fire activities are planned, and no treatment activities will occur in areas where goshawks are nesting. If goshawks are discovered in a treatment area, fire managers will work with the wildlife biologists to determine an acceptable course of action, which may include delaying the treatment schedule or altering the location of the treatment. Potential habitat for the California condor exists in the region, and biologists tracking the condors have reported them nearby. If condors are found inhabiting portions of the Shivwits region, those areas would be designated as non-treatment zones. Peregrine falcons inhabit and utilize cliff portions of the Shivwits Plateau and the Grand Canyon. All units will be surveyed for bird nests, and all nesting sites will be protected and zoned for non-treatment. In addition, the cliff areas are not within the designated treatment units. Monitoring will continue for other sensitive wildlife species, including bats.	
Riparian Areas	Riparian areas will not be included in the treatment units and will be protected through the construction of control lines and suppression activities.	Lake Mead NRA Prescribed Fire Specialist
Wilderness Areas	Light hand suppression techniques will be employed for all treatment activities. Each treatment unit will be evaluated on a case-by-case basis to determine the appropriate tool. The appropriate tool will depend on the acreage of the treatment area, the location of the unit, the resource goals for that unit, the timing of the treatment, and the staff available for the treatment. Bulldozers will not be used in treatment activities. The only constructed fire line used will be handlines. Treatment units are designed to make use of natural and unnatural fuel breaks, so fire lines will not have to be constructed for each unit. Where fire lines construction is necessary, fire lines and soil scars will be restored after the completion of management activities.	Lake Mead NRA Prescribed Fire Specialist and Wilderness Coordinator
Grazing	Grazing will be temporarily restricted in units when treatment activities are taking place. The restriction will remain in place until the time that park biologists determine that grazing can be reinstated.	GCPNM Range Management Specialist

Impact Topic	Mitigation Required under the Preferred Alternative (Alternative C)	Responsible Party
Air Quality	The Arizona Department of Environmental Quality (ADEQ) smoke management procedures, recommendations, and requirements will be followed during all phases of the prescribed fire. A burn plan will be submitted to ADEQ for approval upon designation of a prescribed fire, followed by a daily burn request and accomplishment report. Monitoring of smoke will be a high priority that will include volume, dispersal, mixing heights, atmospheric conditions, and any other smoke concerns.	Lake Mead NRA Prescribed Fire Specialist
Cultural Resources	Archeological clearances will be completed prior to the initiation of any treatment activities. Fire suppression zones will be designated around known cultural and historic resources that could be adversely affected by fire. A cultural resource specialist will be on site to monitor prescribed fires for adverse impacts to cultural resources and appropriate suppression activities will take place if a determination is made that the fire will adversely impact cultural resources. Suppression activities will include fire crews being dispatched to construct control lines around known cultural and historic resources, removal of downed logs and other heavy fuel sources from sites, and removal of hazardous trees from around structures and ruins. The sites that are identified in the archeological clearance as being susceptible to erosion after burning will be monitored. Known cultural areas will not be treated and if previously unknown cultural resources are discovered, treatment activities will be discontinued in the area.	Lake Mead NRA Cultural Resource Specialist
Visitor Use	Visitors will be informed of treatment activities through signs, press releases, and information provided on the NPS website and at area visitor centers. Visitors will be directed to alternative areas during treatment activities.	Lake Mead NRA Public Information Officer and Prescribed Fire Specialist
Safety	Treatment and fire crews will wear the required personal protective equipment. Each burn plan will contain holding and wildland fire transition plans describing appropriate actions in the event the prescription is exceeded. All burn plans will address the need for alerting park neighbors and appropriate public officials to the objectives and timing of the planned treatment and designate a specific individual as responsible for making these notifications. No prescribed fires will be ignited unless the responsible personnel determine that optimum conditions to prevent the fire from exceeding the prescription exist. Fire suppression zones will be designated around administrative structures, residential area, and recreational sites. Hazard fuel reduction will occur, if determined necessary on a case-by-case	Lake Mead NRA Fire Management Officer

Impact Topic	Mitigation Required under the Preferred Alternative (Alternative C)	Responsible Party
	basis, around residential, historic, and administrative structures. The policies for handling an escaped prescribed fire as contained in NPS Reference Manual 18 and existing interagency agreements will be followed.	
Recreation Area Operations	Fire effects monitoring will be accomplished in selected plots to evaluate the degree to which objectives are accomplished and to ensure that undesired effects are not occurring.	Lake Mead NRA Fire Management Officer

ENVIRONMENTAL CONSEQUENCES OF THE PREFERRED ALTERNATIVE

As documented in the EA, the NPS has determined that the Preferred Alternative (Alternative C) can be implemented with no significant adverse effects to safety, soils and vegetation, riparian resources, wildlife, special status species, air quality, scenic quality, cultural resources, wilderness values, grazing, recreation area operations, and the visitor use and experience. The Preferred Alternative would not affect designated ecologically significant or critical areas, wild or scenic rivers, designated coastal zones, water resources and aquatic life, Indian Trust resources, prime and unique agricultural lands, sites on the US Department of the Interior's National Registry of Natural Landmarks, sole or principal drinking water aquifers, or NRA operations. In addition, there are no potential conflicts between the Preferred Alternative and land use plans, policies, or controls (including state, local, or Native American) for the project area.

Regarding energy requirements and conservation potential, the treatment operations under the Preferred Alternative would require the increased use of energy for the transportation of personnel and materials, and for the monitoring of treatment activities. However, overall, the energy from petroleum products required to implement the alternative would be insubstantial when viewed in light of the production costs and the effect of the national and worldwide petroleum reserves.

There are no potential effects to local or regional employment, occupation, income changes, or tax base as a result of this project. The Preferred Alternative project area is not populated and, per Executive Order 12898 on Environmental Justice, there are no potential effects on minorities, Native Americans, women, or the civil liberties (associated with age, race, creed, color, national origin, or sex) of any American citizen. No disproportionate high or adverse effects to minority populations or low-income populations are expected to occur.

Following the implementation of the mitigation and monitoring measures, the environmental consequences of implementing the Preferred Alternative are as follows:

Soils and Vegetation	In the long-term, there would be beneficial impacts to the soils and vegetation in the treatment units as the natural processes are restored and grasses and forbs are re-established. Ponderosa pine trees could increase in vigor as a result of restoration thinning. Soils would generally benefit from prescribed fires through the replacement of nutrients. There could be slight erosion immediately after treatment until vegetative recovery occurs, creating minor impacts to the soils. Some non-native vegetation could move into areas after treatment activities. This could lead to minor to moderate adverse impacts if mitigation and follow-up treatments are not successful in preventing the long-term establishment of non-native species in treatment units. Monitoring will support the modification of treatment activities if non-natives are shown to be spreading in the area.
Wildlife	Treatment activities could result in improved wildlife habitat in the long-term, with the increased vigor of ponderosa pine stands, and the increases in biodiversity and understory growth, the creation of forest mosaics, and the increase in forage species in pinyon-juniper communities. Wildlife could be temporarily displaced during treatment activities and some direct mortality could occur if animals are unable to move away from the fire activities, creating minor to moderate impacts.
Sensitive, Threatened, and Endangered Species	The preferred alternative is not likely to adversely affect threatened and endangered species. In the long-term, as habitat conditions improve, more potential habitat could be available for sensitive, threatened, and endangered species. As biologists continually monitor the area for sensitive, threatened, and endangered species, more information will be gained about the habitat requirements, which would lead managers to develop more specific management treatment activities that would lead to improved habitat conditions.
Riparian Areas	Since riparian areas are designated as suppression zones, no impacts will occur unless a fire exceeds prescription levels.
Wilderness Areas	Use of mechanical tools could temporarily detract from the wilderness experience, but it would not have long-term negative impacts to the wilderness character. The impacts of the treatment activities are considered minor since they would be short-term. The reintroduction of fire into the ecosystem could lead to the restoration of natural processes in the area, and return the area to a more natural condition, leading to long-term beneficial impacts.
Grazing	Grazing would be temporarily prohibited in units during treatment operations and until the time range managers determine the areas are again suitable for grazing. In the long-term, as grasses and forbs re-establish, grazing conditions could improve in treatment units.

Air Quality	Temporary adverse impacts to air quality would occur in the region due to smoke from prescribed fires. The fumes from mechanized equipment could create temporary, localized impacts to the project air quality. Even though this impact is short-term and temporary, decreased visibility in the Grand Canyon region is a major concern and prescribed fires could create minor to major impacts on a temporary basis.
Scenic Quality	Smoke during prescribed fires could temporarily affect the scenic quality in the region. Burned areas could temporarily detract from the scenic quality of the area. In the long-term, scenic quality should improve as the viewshed would be opened up and a more natural skyline would be created. The impacts to the scenic quality are considered minor, since they would be short-term and treatment will eventually improve the scenic quality of the area.
Cultural Resources	Cultural resources that could be damaged or destroyed by fire will be contained within suppression zones, therefore, no impacts will occur from prescribed fires. Archeological resources should not be impacted by low intensity fires, however, high-intensity fires could damage these resources. Secondary impacts may include exposure of previously covered cultural resources as a result of soil erosion or trampling and ground disturbance during treatment activities. Pre-treatment surveys, mitigation and protective measures would prevent damage to cultural resources from treatment activities.
Visitor Use	Visitors will be temporarily displaced from treatment areas. Visitors may be temporarily disturbed by noise and treatment activities in the vicinity of the project area. These impacts are considered minor and short-term, since they would be temporary and localized in the project area, and there are other opportunities for visitor use elsewhere in the region.
Safety	There is a risk with treatment activities to fire crews from the use of mechanized equipment, and the prescribed fire. Crews are properly trained, but accidents still could occur. Prescribed fires that escape containment could threaten the safety of fire crews and adjacent communities. This likelihood is slim, but is still considered when evaluating the burn options. Vegetation treatment will reduce the buildup of hazardous fuels, decreasing the possibility of a large, difficult to manage, wildfire, thus improving safety in the region.
Recreation Area Operations	An increase in current staff levels, either permanent, seasonal, or contract crews, in Lake Mead NRA and GCPNM would be necessary to effectively implement the treatment program, mitigation, and monitoring requirements. More training would be required. Equipment would have to be acquired for the operation.

PUBLIC INVOLVEMENT

In February 2001, a 30-day public scoping period was initiated through the release of a press release and through the Lake Mead NRA website. No comments were received. Internal scoping took place between the Lake Mead NRA interdisciplinary team and biologists and fire specialist from the U.S. Geological Survey, Biological Resources Division on September 17, 2001, and

follow-up meetings occurred with the staff of Grand Canyon-Parashant National Monument on April 9, 2002.

Tribal consultations were initiated with a letter to interested tribes on August 2, 2001. Members of the Lake Mead NRA interdisciplinary team met with tribal representatives to discuss the proposed treatment program on the Shivwits Plateau. Consultation meetings occurred on August 16, 30, and 31, September 5, and October 3, 2001.

A 30-day public comment period was provided for public review of the EA between February 1 and March 4, 2002. Public notice of the availability of the EA was published in local newspapers and on the park's website. Seventy-five copies of the EA were circulated to individuals, businesses, and organizations on the recreation area's mailing list, and to all area libraries. In addition, letters announcing the availability of the EA were sent to the park's general mailing list, which includes approximately 200 individuals, organizations, and agencies. An electronic version of the EA was available on the park's webside, and the EA could be requested in writing and by telephone. Various federal and state resource agencies, Native American tribes, and members of the public were consulted in the review of the EA.

In total, three comment letters were received on the EA during the 30-day comment period that extended from February 1 through March 4, 2002. The Arizona Game and Fish Department appreciated the recognition of habitat requirements for game and nongame species, and recommended that the impacts of treatment be analyzed on a site-specific basis. They also recommended that treatment dates and seasons be adjusted if it is determined through monitoring that negative impacts to wildlife species would occur.

Informal consultation was initiated with the U.S. Fish and Wildlife Service by NPS memorandum on February 1, 2002. The U.S. Fish and Wildlife Service provided species lists and habitat requirements, and supported the NPS efforts listed in the EA to identify and avoid impacts to listed and sensitive species in the project area, and to improve habitat for sensitive species. They also recommended protection of riparian habitat. The concurrence memorandum was received September 23, 2002, and is attached.

The Sierra Club provided comments on the EA and had several questions on the alternatives. These questions were addressed in a follow-up letter and are attached.

CONSULTATIONS AND PERMITTING

The following approvals and permits from jurisdictional agencies have been or will be obtained before the implementation of Alternative C:

- Arizona Department of Environmental Quality – A separate burn plan will be submitted to the Arizona Department of Environmental Quality, followed by a daily burn request and accomplishment report.
    - Arizona State Historic Preservation Office – The Arizona State Historic Preservation Office (ASHPO) was afforded an opportunity to comment on the undertaking and its effects on historic and archaeological resources that could be eligible for the State or National Registers of Historic Places. The ASHPO has no comments at this time and will review project specific archeological clearances on a case by case basis.
- Concurrence that no historic properties will be adversely affected and that effects from the project on historic and archaeological resources have been taken into account, in accordance with Section 106 of the National Historic Preservation Act.

- Consultations with Native American tribes – Consultations occurred with area Native American tribes and their concerns were addressed. Consultations included meetings with local tribes, and consultation letters. The consultation package is attached. No objections relating to the selection of the preferred alternative were submitted.

- Superintendent's Approval – In accordance with NPS policies, the Superintendent, Lake Mead NRA, will review the burn plan prior to authorizing any prescribed fire.

- Informal consultations occurred with the U.S. Fish and Wildlife Service. A determination of no effect/not likely to adversely affect has been made with the adoption of the mitigation measures and monitoring programs. The final determination memorandums are attached.

BASIS FOR DECISION

The NPS selects Alternative C, the Preferred Alternative, because it would ensure the protection of park resources and values by helping to restore the natural process on the Shivwits Plateau region of Lake Mead NRA. Under the adaptive management program, managers would work with scientists to determine if the methods utilized were producing the desired results. If the desired results are achieved, the vegetative community and wildlife habitat in the region would improve. Soil erosion would decrease, and biodiversity would increase. Fire would be restored as a natural process. If the desired results are not achieved with this experimental program, the park managers would work with scientists to determine the alternative actions and develop an additional plan and evaluate the alternatives under a separate environmental document.

Implementation of the Preferred Alternative would allow for mitigation measures and monitoring activities, such as surveying for and protecting cultural resources, the initiation of scientific studies to determine fire and treatment effects, the survey for and protection of potential threatened and endangered species and their habitat.

Alternative A, the No Action Alternative, is not selected because it would not allow park managers to meet the resource management objectives to: 1) restore fire as a natural process on the Shivwits Plateau region of Lake Mead NRA; 2) restore fuel loadings and ecosystem structure in vegetative communities that have been altered by past management practices; 3) to increase biodiversity and promote the establishment of native grasses and forbs; and 4) to restore wildlife habitat and increase potential habitat for native species.

Alternative B, Vegetation treatment through the continuation of an experimental prescribed fire program, is not selected because this method alone has not been shown to produce the results necessary to meet the above stated management objectives. Though the use of prescribed fire has produced some successful results in certain treatment units on the Shivwits Plateau, ponderosa pine units may require restoration thinning and the use of mechanical treatments, and pinyon-juniper units, may require pre-treatment with mechanical equipment.

Alternative D, Vegetation treatment utilizing an experimental chemical treatment and follow-up burn program, was not selected due to the lack of available information and management concerns over the effects of chemical treatment on the ecosystem. Instead, as described under the preferred alternative, a small-scale chemical treatment plot will be established to monitor the long-term effects of chemical treatment on the environment and its feasibility for future use. Any future use of herbicide beyond the described experimental treatment would be evaluated in a separate compliance document.

The Preferred Alternative complies with the Endangered Species Act. As outlined in Section 106 of the National Historic Preservation Act of 1966, as amended, the Arizona State Historic Preservation Office

(ASHPO) was afforded an opportunity to comment on the undertaking and its effects on historic and archaeological resources that could be eligible for the State or National Registers of Historic Places. The ASHPO has no comments at this time and will review project specific archeological clearances on a case by case basis.

IMPAIRMENT OF PARK RESOURCES OR VALUES

The effects of the Preferred Alternative will not impair Park resources or values necessary to fulfill specific purposes identified in the Park's enabling legislation. Impacts documented in the EA and summarized above will not affect resources or values key to the natural and cultural integrity of the Park or alter opportunities for enjoyment of the Park. The Preferred Alternative will not impair Park resources and will not violate the NPS Organic Act. This conclusion is based on a thorough analysis of the impacts described in the environmental assessment, the agency and public comments received, and the professional judgment of the decision-maker in accordance with National Park Service *Management Policies, 2001*.

CONCLUSION AND BASIS FOR DETERMINATION

Based on the analysis completed in the EA, the capability of the mitigation measures to reduce, avoid, or eliminate impacts, and with due consideration of public response, the NPS determined that there are no cumulative, indirect effects, or connected actions with the potential for significant impacts. Therefore, an environmental impact statement is not required, therefore, the selected action may be implemented as soon as practical. The USFWS and Arizona SHPO concur with these determinations.

Based on the foregoing determination, I find that the Preferred Alternative does not constitute a major federal action significantly affecting the quality of the human environment. Therefore, in accordance with the National Environmental Policy Act of 1969 and regulations of the Council on Environmental Quality (40 Code of Federal Regulations 1508.9), an environmental impact statement will not be prepared for this project.

Recommended:

/s/ Gary Warshefski for _____ 9/27/02

William K. Dickinson, Superintendent Date
Lake Mead National Recreation Area

Approved:

/s/ Arthur E. Eck for _____ 10/16/02

Jonathan B. Jarvis Date
Regional Director, Pacific West Region

APPENDIX B
Scoping Press release

NEWS RELEASE U.S. Department of the Interior

National Park Service

FOR IMMEDIATE RELEASE **Release No. 00101**
Dec. 13, 2000

Lake Mead NRA seeks comment for fire management plan

BOULDER CITY, NV – Officials from Lake Mead National Recreation Area in Boulder City are seeking public comments leading to the updating of the current fire management plan.

The current fire management plan is scheduled to expire in September, 2001 and National Park Service regulations require it be updated and reissued.

A team of fire and environmental specialists at Lake Mead NRA has combined to conduct a survey of alternatives for fire management at the 1.5 million-acre recreation area. These alternatives and any public comment will be evaluated via an environmental assessment that will lead to a preferred alternative and a new detailed fire management plan.

Under the current plan, park mangers use a combination of techniques for fire management, from full suppression of all human or natural caused wildfires in the low desert to wild land fire use in specific areas. This includes Ponderosa Pine, pinyon-juniper and sagebrush habitat in the higher elevations of the recreation area. Mangers also use prescribed fire in selected areas to reduce hazardous fuels, help control exotic vegetation and to achieve other park resource management objectives.

"The purpose of the fire management plan is to guide us in the proper management of fire within the recreation area," said Bill Dickinson, acting superintendent of Lake Mead NRA. "We hope scientific input as well as comments from the public will help us prepare a new, workable fire management plan."

Lake Mead National Recreation Area in Boulder City, NV is a unit of the National Park Service.

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For additional information on this or other National Park Service information, please contact Lake Mead NRA at 702-293-8947.

Appendix C
U.S. Fish and Wildlife Service Listing of Threatened and Endangered Species

(accessed from http://ifw2es.fws.gov/EndangeredSpecies/lists/ListSpecies.cfm on January 8, 2003)

Mohave County

Common Name	Scientific Name	Listing Status	More Info
Arizona cliff-rose	*Purshia subintegra*	E	P
bald eagle	*Haliaeetus leucocephalus*	AD, T	P
bonytail chub	*Gila elegans*	E	P
brown pelican	*Pelecanus occidentalis*	DM, E	P
California condor	*Gymnogyps californianus*	E, EXPN	P
desert tortoise	*Gopherus agassizii*	SAT, T	P
Fickeisen plains cactus	*Pediocactus peeblesianus fickeiseniae*	C	P
Holmgren milk-vetch	*Astragalus holmgreniorum*	E	P
Hualapai Mexican vole	*Microtus mexicanus hualpaiensis*	E	P
humpback chub	*Gila cypha*	E	P
Jones cycladenia	*Cycladenia humilis var. jonesii*	T	P
Mexican spotted owl	*Strix occidentalis lucida*	T	P
razorback sucker	*Xyrauchen texanus*	E	P
Siler pincushion cactus	*Pediocactus (=Echinocactus,=Utahia) sileri*	T	P
Southwestern willow flycatcher	*Empidonax traillii extimus*	E	P
Virgin River chub	*Gila robusta seminude*	E	P
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	C	P
woundfin	*Plagopterus argentissimus*	E, EXPN	P
Yuma clapper rail	*Rallus longirostris yumanensis*	E	P

E -- Endangered
T -- Threatened
EmE -- Emergency Listing, Endangered
EmT -- Emergency Listing Threatened
EXPE, XE -- Experimental Population, Essential
EXPN, XN -- Experimental Population, Non-Essential
SAE, E(S/A) -- Similarity of Appearance to an Endangered Taxon
SAT, T(S/A) -- Similarity of Appearance to a Threatened Taxon
PE -- Proposed Endangered
PT -- Proposed Threatened
PEXPE, PXE -- Proposed Experimental Population, Essential
PEXPN, PXN -- Proposed Experimental Population, Non-Essential
PSAE, PE(S/A) -- Proposed Similarity of Appearance to an Endangered Taxon
PSAT, PT(S/A) -- Proposed Similarity of Appearance to a Threatened Taxon
C -- Candidate Taxon, Ready for Proposal

D3A -- Delisted Taxon, Evidently Extinct
D3B -- Delisted Taxon, Invalid Name in Current Scientific Opinion
D3C -- Delisted Taxon, Recovered
DA -- Delisted Taxon, Amendment of the Act
DM -- Delisted Taxon, Recovered, Being Monitored First Five Years
DO -- Delisted Taxon, Original Commercial Data Erroneous
DP -- Delisted Taxon, Discovered Previously Unknown Additional Populations and/or Habitat
DR -- Delisted Taxon, Taxonomic Revision (Improved Understanding)
AD -- Proposed Delisting
AE -- Proposed Reclassification to Endangered
AT -- Proposed Reclassification to Threatened

State of Nevada -- 37 listings

Animals -- 29

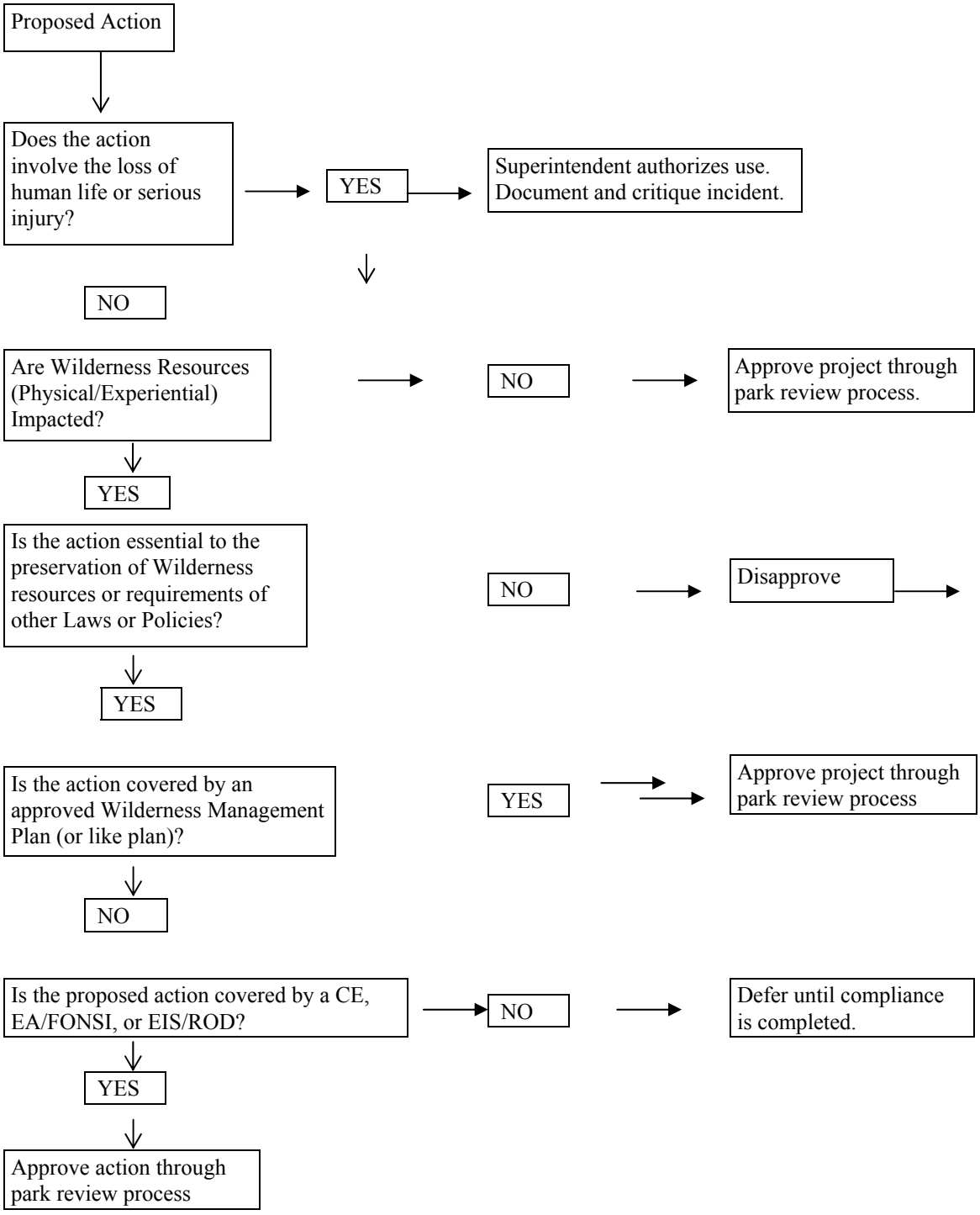
Status	*Listing*
E	Chub, bonytail (*Gila elegans*)
E	Chub, Pahranagat roundtail (*Gila robusta jordani*)
E	Chub, Virgin River (*Gila seminuda (=robusta*)
E	Cui-ui (*Chasmistes cujus*)
E	Dace, Ash Meadows speckled (*Rhinichthys osculus nevadensis*)
E	Dace, Clover Valley speckled (*Rhinichthys osculus oligoporus*)
T	Dace, desert (*Eremichthys acros*)
E	Dace, Independence Valley speckled (*Rhinichthys osculus lethoporus*)
E	Dace, Moapa (*Moapa coriacea*)
T	Eagle, bald (lower 48 States) (*Haliaeetus leucocephalus*)
E	Flycatcher, southwestern willow (*Empidonax traillii extimus*)
E	Frog, mountain yellow-legged (southern California DPS) (*Rana muscosa*)
T	Naucorid, Ash Meadows (*Ambrysus amargosus*)
E	Poolfish, Pahrump (*Empetrichthys latos*)
E	Pupfish, Ash Meadows Amargosa (*Cyprinodon nevadensis mionectes*)
E	Pupfish, Devils Hole (*Cyprinodon diabolis*)
E	Pupfish, Warm Springs (*Cyprinodon nevadensis pectoralis*)
E	Skipper, Carson wandering (*Pseudocopaeodes eunus obscurus*)
T	Spinedace, Big Spring (*Lepidomeda mollispinis pratensis*)
E	Spinedace, White River (*Lepidomeda albivallis*)
E	Springfish, Hiko White River (*Crenichthys baileyi grandis*)
T	Springfish, Railroad Valley (*Crenichthys nevadae*)
E	Springfish, White River (*Crenichthys baileyi baileyi*)
E	Sucker, razorback (*Xyrauchen texanus*)
T(S/A)	Tortoise, desert (outside/taken from Sonoran Desert) (*Gopherus agassizii*)
T	Tortoise, desert (U.S.A., except in Sonoran Desert) (*Gopherus agassizii*)
T	Trout, bull (U.S.A., conterminous, lower 48 states) (*Salvelinus confluentus*)
T	Trout, Lahontan cutthroat (*Oncorhynchus clarki henshawi*)
E	Woundfin (except Gila R. drainage, AZ, NM) (*Plagopterus argentissimus*)

Plants -- 8

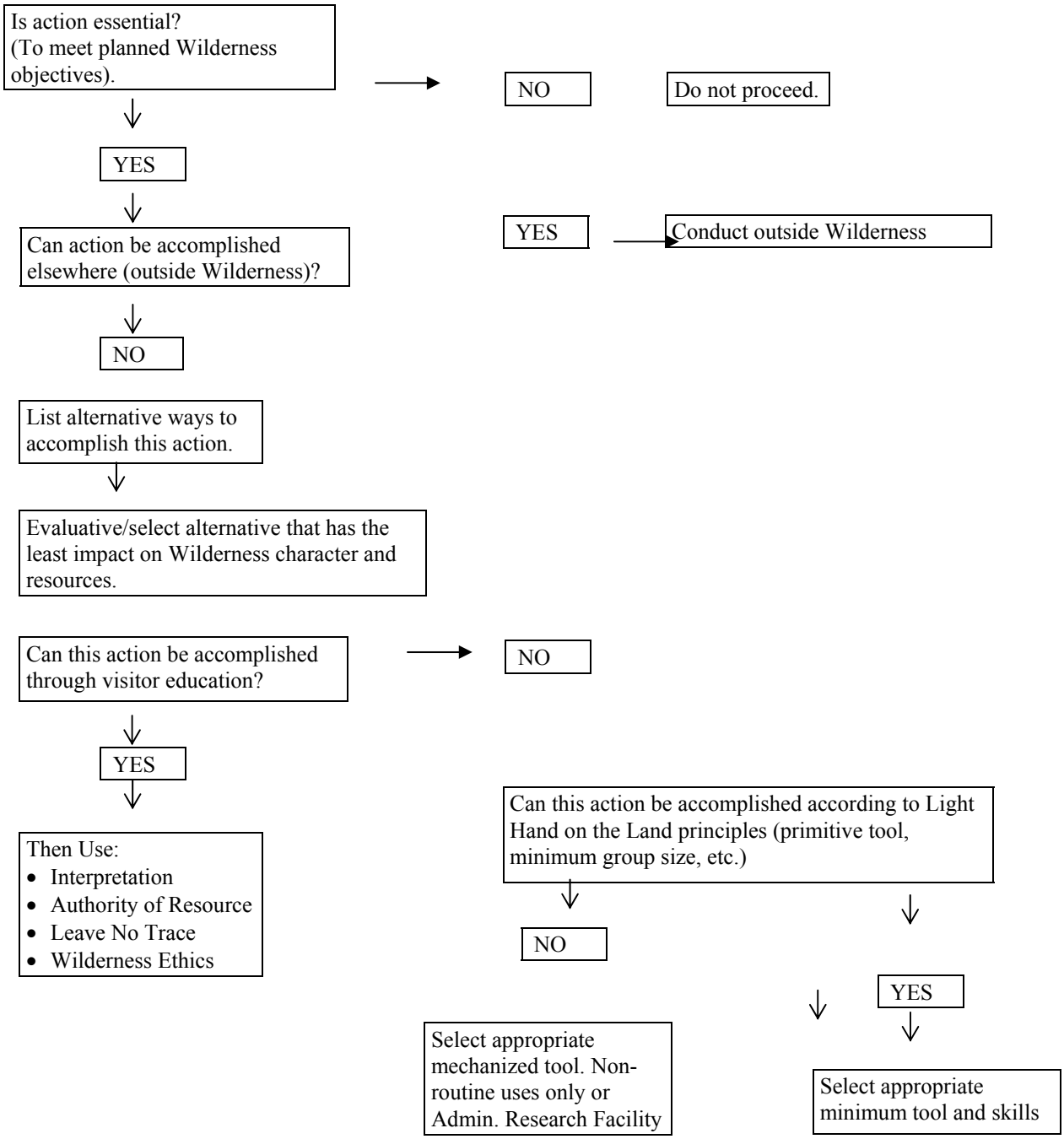
Status	Listing
T	Milk-vetch, Ash meadows (*Astragalus phoenix*)
T	Centaury, spring-loving (*Centaurium namophilum*)
T	Sunray, Ash Meadows (*Enceliopsis nudicaulis* var. *corrugata*)
E	Buckwheat, steamboat (*Eriogonum ovalifolium* var. *williamsiae*)
T	Gumplant, Ash Meadows (*Grindelia fraxino-pratensis*)
T	Ivesia, Ash Meadows (*Ivesia kingii* var. *eremica*)
T	Blazingstar, Ash Meadows (*Mentzelia leucophylla*)
E	Niterwort, Amargosa (*Nitrophila mohavensis*)

APPENDIX D: Minimum Requirement Analysis

PART 1



Minimum Requirement Analysis – PART 2



Minimum Requirement Analysis
Decision Screening Questions

1. Does your action insure that wilderness is not occupied and modified?

2. Does your action maintain or move the Wilderness toward less human influence within legal constraints?

3. Does your rationale allow Wilderness to retain solitude and elements of surprise and discovery?

4. Did you evaluate the traps of making decisions based on economy, convenience, comfort, or commercial value?

5. Did you look beyond the short-term outputs to ensure that future generations will be able to use and enjoy the benefits of an enduring resource of Wilderness?

6. Does the alternative support the Wilderness resource in its entirety rather than maximizing an individual resource?

7. Do you recognize the unique characteristics for this particular Wilderness?

8. Does the action prevent the effects of human activities from dominating natural conditions and processes.

APPENDIX E

Minimum Impact Suppression Tactics (M.l.S.T.)
(Taken From BLM Guidelines, dated February 1995)

Concept

Minimum Impact Suppression Tactics (MIST) is not intended to represent a separate or distinct classification of firefighting tactics but rather a mind-set of how to suppress a wildfire while minimizing the long-term effects of the suppression action. When the term MIST is used in this document, it reflects the above principle.

The concept of MIST is to use the minimum amount of forces necessary to effectively achieve the fire management protection objectives consistent with ecosystem management objectives. It implies a greater sensitivity to the impacts of suppression tactics and their long-term effects when determining how to implement an appropriate suppression response. In some cases, MIST may indicate cold trailing or wet line may be more appropriate than constructed hand line.

Goal

The goal of MIST is to halt or delay fire spread in order to maintain the fire within predetermined parameters while producing the least possible impact on the resource being protected. These parameters are represented by the initial attack incident commander's assessment of the situation in the case of a new start or by the escaped fire situation analysis (EFSA) in the case of an escaped fire (note: EFSA's changed to WFSA's in 1997).

Appropriate Suppression Response

When selecting an appropriate suppression response, firefighter safety remains the highest priority. In addition, fire managers must be assured the planned actions will be effective and will remain effective over the expected duration of the fire.

Actions wilI be anchored to the standard fire orders and watch out situations.

The key challenge to the line officer, fire manager and firefighter is to be able to select the wildfire suppression tactics that are appropriate given the fire's probable or potential behavior. The guiding principle is always least cost plus loss while meeting ecosystem management objectives. It is the second part of this statement that must be recognized more than it has in the past. It is important to consider probable rehabilitation needs as a part of selecting the appropriate suppression response. Tactics that reduce the need for rehab are preferred whenever feasible.

These actions, or MIST, rnay result in an increase in the amount of time spent watching, rather than disturbing, a dying fire to insure it does not rise again.

Suppression Responsibility

As stated previously, safety is the highest priority. All action will be anchored to the standard line orders and watch out situations. Safety will remain the responsibility of each person involved with the incident. MIST guidelines are not intended to replace firefighter judgment. Determination of suppression needs well in advance of the fire is a major asset in effectively applying MIST.

Initial/Extended Attack

Incident Commander

To understand and carry out an appropriate suppression response which will best meet the land management objectives of the area at the least cost plus loss.

- Insure all forces used on the fire understand the plan for suppressing the fire in conjunction with MIST,

- Maintain communication with responsible fire manager or line officer to insure understanding and support of tactics being used on the fire.

- Evaluate and provide feedback as to the tactical effectiveness during and after fire incident.

- If the fire incident is in wilderness, assure authorization has been given if motorized or mechanical equipment is determined to be necessary.

Project Fire

Type I/II Incident Commander:

- Insure all forces used on the fire understand the plan for suppressing the fire in conjunction with MIST.

- Insure instructions given by the responsible line officer verbally are carried through into the EFSA.

- Establish and nurture a close dialogue with the resource advisor assigned to the fire team.

- Review actions on site and evaluate for compliance with line officer direction and effectiveness at meeting fire management protection objectives.

Responsible Line Officer

- To understand and carry out an appropriate suppression response which will best meet the objectives utilizing MIST,

- To transmit the land management objectives of the fire area to the fire team and to define specific fire management objectives.

- Periodically review for compliance, Resource Advisor Participate at fire team planning sessions, review incident action plans and attend daily briefings to emphasize resource concerns and management's expectations.

- To insure the interpretation and implementation of EFSA and other oral or written line officer direction is adequately carried out.

- Provide specific direction, guidelines, and monitoring actions to insure successful MIST activities as needed.

- Provide assistance in updating EFSA when necessary.

- Participate in incident management team debriefing and assist in evaluation of team performance related to MIST.

- If wilderness, assure compliance with wilderness management objectives.

List of Considerations

Fire Line Construction

Use cold-trail wet line or combination when appropriate.
If constructed fire line is necessary, use only width and depth necessary to cheek fire spread.

Consider use of fire line explosives for line construction and felling when possible to meet the need for more natural appearing stumps.

Minimize bucking and cutting of trees to establish fire line; build line around logs and standing trees whenever possible.

Where appropriate for low intensity fire, trails can be utilized as fire line in lieu of constructing new line.

Constantly re-check cold trailed fire line.

Limb vegetation adjacent to fire line only as needed to prevent additional fire spread.

During fire line construction, cut shrubs or small trees only when necessary. Make all cuts flush with the ground.

Minimize felling of trees and snags unless they threaten the fire line or endanger workers.

Line around tree bases near fire line, if it is likely they will ignite.

Fire line location is the key element in helping maximize application of MIST.

Burn Out

Allow fire to burn to natural barriers.

Burn out and use a low impact tool like a swatter.

Areas that can be called black line should be used as such, and patrolled often.

During burn out and firing operations, use low intensity backfires and short duration strip fires. Avoid high intensity head fires or other heavy handed firing operations.

Mop Up

Do minimal spading; restrict spading to hot areas near fire line.

Cold-trail charred logs near fire line, do minimal tool scarring.

Minimize bucking of logs to extinguish fire or to check for hot spots; roll the logs instead if possible.

Refrain from making bone yards.

Consider allowing large logs to burnout. Use a lever rather than bucking to manage large logs that must be extinguished.

Use gravity socks in stream sources and/or a combination of water buckets and fold-a-tanks to minimize impacts to streams.

Consider using infrared detection devices along perimeter to reduce risk.

Personnel should avoid using rehabilitated fire lines as travel corridors whenever possible because of potential soil compaction and possible detrimental impacts to rehab work, i.e. water bars.

Remove or limb only those fuels that if ignited have potential to spread fire outside the fire line.

If burning trees/snags pose a serious threat of spreading fire brands, extinguish fire with water or dirt whenever possible. Consider felling by blasting when feasible.

Consider felling single snag fires by crosscut or explosives.

Align saw cuts to minimize visual impacts from more heavily traveled corridors. Slope cut away from line of sight when possible.

Discourage use of newly established trails created during the suppression effort.

Use caution when operating pumps or engines with foaming agents to avoid contamination of water sources.

Logistics

Campsite Considerations/Personal/Camp Conduct/Personnel Movement

Locate facilities (fire camp, helispots} outside of wilderness whenever possible.

Minimize the overall degradation of the wilderness resource.

Facilities shall be temporary.

Utilize natural openings for camps, helispots, or staging areas whenever possible.

Minimize the number of locations used for spike camps, helispots, etc.

Coordinate with the Resource Advisor in choosing a site with the most reasonable qualities of resource protection and safety concerns.

Evaluate short-term low impact camps such as coyote or spike versus use of longer-term, higher impact camps.

Use existing campsites.

New site locations should be on impact resistant and naturally draining areas such as rocky or sandy soils, or openings with heavy timber.

Avoid camps in meadows along streams or on the lakeshore. Locate at least 200 feet from lakes, streams, trails, or other sensitive areas.

Consider impacts on both present and future users. An agency commitment to wilderness values will promote those values to the public.

Lay out the camp components carefully from the start. Define cooking, sleeping, latrine, and water supply.

Minimize the number of trails and ensure adequate marking.

Consider fabric ground cloth for protection in high use areas such as around cooking facilities.

Use commercial portable toilet facilities where available. If these cannot be used, a latrine hole should be utilized.

Where there are no facilities, dig a cat-hole 6 to 8 Inches deep and at least 200 feet from sensitive areas. Completely bury waste and paper.

Select latrine sites a minimum of 200 feet from water sources with natural screening.

Do not use nmls

Constantly evaluate the impacts that will occur, both short and long term.

Use "leave no trace" camping techniques.

Pack out all garbage, including left over food.

Minimize disturbance to land when preparing bedding site. Do not clear vegetation or trench to create bedding sites.

Use stoves for cooking, when possible, If a campfire is used, limit to one site and keep it as small as reasonable. Build either a 'pit' or 'mound' type fire. Avoid use of rocks to ring fires.

Use down and dead firewood. Use small diameter wood for less waste.

Don't burn plastics or aluminum "pack it out" with other garbage.

Keep a clean camp and store food and garbage so it is unavailable to wildlife. Ensure items such as empty food containers are clean and odor free, never bury them.

Select travel routes between camp and fire and define clearly.

Carry water and bathe away from lakes and streams.

Personnel must not introduce soaps, shampoos, or other personal grooming chemicals into waterways.

Pick up and remove all flagging, garbage, litter, and equipment. Dispose of trash appropriately.

Clean fire pit of unburned materials and fill back in.

Naturalize carnpfire area by scattering "dead" ashes in nearby brush and returning site to a natural appearance.

In non-wilderness *camps,* minimize vehicle use in the camp are. Off-road vehicle use should be avoided when possible.

Aviation Management

A goal of Minimum Impact Suppression Tactics is to minimize the disturbance caused by air operations during an Incident.

Aviation use Guidelines

The use of aircraft in wilderness areas must be authorized at the Superintendent level.

Maximize back haul flights as much as possible.

Use long-line remote hook in lieu of constructed helispots for delivery or retrieval of supplies and gear.

Use natural openings for helispots and para-cargo landing zones as far as practical. If construction is necessary, avoid high visitor use areas.

Consider maintenance of existing helispots over creating new sites.

Buck and limb only what is necessary to achieve safe, practical operating space in and around the landing pad area.

Coordinate activities with the resource advisor to help address resource protection and safety concerns,

Retardant Use/Foaming Agents

During initial attack, fire managers must weigh the non-use of retardant with the probability of initial attack crews being able to successfully control or contain a wildfire. If it is determined that use of retardant may prevent a larger, more damaging wildfire, then the manager rnight consider retardant use even in sensitive areas. This decision must take into account all values at risk and the consequence of larger firefighting forces' impact on the land.

Consider impacts of water drops versus use of foam/retardant. If foam/retardant is deemed necessary, consider use of foam before retardant use.

Do not drop retardant or other suppressants near surface waters, or springs.

Use caution when operating pumps or engines with foaming agents to avoid contamination of water sources,

Minimum Impact Considerations *(After Suppresion Disturbance)*

Fire rehabilitation needs are normally identified by the fire rehabilitation team.

During implementation, the resource advisor should be available for expert advice and support of personnel doing this work as well as quality control.

Fire minimum impact objectives should be completed as part of ongoing MIST activities, mop-up, camp demob, and fireline close out.

Replace dug out soil and/or duff and obliterate any berms created during the suppression effort unless needed to reduce concentrated flows of water.

Where trees were cut or limbed, cut stumps flush with the ground, scatter limbs and boles out of sight in unburned area.

Camouflage stumps and tree boles using rocks, dead woody material, fragments of stumps, bolewood, limbs, soil and fallen or broken green branches. Scattered sawdust and shavings will assist in decomposition and be less noticeable.

Remove newly cut tree boles that are visible from trails or meadows.

Drag other highly visible woody debris created during the suppression effort into timbered areas and disburse.

Tree boles that are too large to move should be slant cut so a minimal amount of the cut surface is exposed to view. Chopping up the surface with an ax or pulaski, to make it jagged and rough, will speed natural decomposition.

Burned and partially burned fuels that were moved should be returned to a natural arrangement rather than a "bone yard" appearance,

Newly established trails created by suppression efforts should be covered with brush, limbs, small diameter poles, and rotten logs in a naturally appearing arrangement.

Tear out stumps or dams, where they have been used, and return site to a natural condition.

Replace any displaced rocks or streambed material that has been removed.

Reclaim streambed to its pre-disturbed state, when appropriate.

Where soil has been exposed and compacted, such as in camps, on user-trails, at helispots and pump sites, scarify the top 2 to 4 inches and scatter with needles, twigs, rocks, and dead branches.

Blend campsites with natural surroundings by filling in and covering latrine with soil, rocks, and other natural material.

If seeding is called for, utilize species compatible with long term ecosystem management of the area.

Cultural Resources

Cultural resources are frequently found within wilderness areas. Archaeological and historical sites are not renewable and cannot be replaced. Look, photograph, enjoy, but do not disturb. Climbing in, on. or around ruins will speed up destruction of the site. Practice minimum impact techniques and view from a distance. Avoid touching plaster walls as touching leaves oils from your skin on the rock. These oils hasten the deterioration of the artwork as well as the cultural/spiritual importance. Do not remove artifacts. Respect the time and energy these ancient inhabitants put into their work. It has survived for hundreds of years. Help preserve it for future generations.

Demobilization

Because demob is often a time when people are tired or when weather conditions are less than ideal, enough time must be allowed to do a good job. When moving people and equipment, choose the most efficient and least impacting method to both the landscape and the overall fire organization mission.

Exit Review – MIST Evaluation

An exit review of MIST practices is important for any fire occurrence so management can find out how things went. Activities involving data collection, documentation and recommendations will help identify areas needing Improvement, and to formulate strategies and to produce quality work in the future. This activity is especially important in wilderness and like sensitive areas due to their fragility and inclination to long-term damage by human Impacts.

Resource advisors with a good background in both wilderness and fire should take part in exit reviews for overhead teams as part of the MIST evaluation. They are the people who have the experience and knowledge to provide information required to make the evaluation meaningful and productive. This process and report can, in most cases, be fairly simple and to the point. The evaluation emphasis should be on the MIST actions and not on the effects of the fire or rehabilitation plans.

Evaluation should be completed on wildfires exceeding 100 acres and on a sample of fires less than 100 acres. It is appropriate to evaluate a diversity of fires, ranging from a spot fire suppressed by smoke chasers or jumpers to a large project fire managed by an overhead team.

Observations will be documented in a brief report to the line officer with a copy to the appropriate incident commander. In the report, the evaluator will include recommendations for ensuring fire suppression activities on similar lands. It is important that the evaluator recognizes

and commends the initial attack forces or overhead team for positive activities. Make special note of the extra efforts and sensitivity to suppression impacts.

Leave No Trace

Plan Ahead and Prepare

Learn about the regulations and issues that apply to the area you are visiting.

Avoid popular areas during times of high use.

Choose equipment and clothing in earthtone colors.

Repackage food into lightweight reusable containers to pack out with you.

Travel Lightly

Visit the backcountry in small groups.

Stay on designated trails. Walk single file in the middle of the path.

Do not cut across switchbacks.

Spread out to avoid creating trails when traveling cross-country.

Read your map and avoid marking trails with rock cairns, tree scars or ribbons.

Step to the downhill side of the trail and talk softly when encountering horseback riders.

Campsite

Choose an existing, legal site whenever possible. Restrict activities to the area where vegetation is compacted or absent.

Camp at least 75 paces (200 feet) from lakes, streams, and trails.

Always choose sites that will not be damaged by your stay.

Preserve the feeling of solitude by hiding your camp from view.

Do not construct structures, furniture, or dig trenches.

Remember, good campsites are found, not made. Altering the site should be unnecessary.

Campfires

Fire use can scar the backcountry. Use a lightweight stove for cooking.

Where fires are permitted, use existing fire rings, away from large rocks or overhangs.

Do not char rocks by building new rings. Make your fire in a metal roasting pan, or learn to construct a mound fire.

Gather sticks from the ground which are no larger than the diameter of your wrist.

Do not snap branches off live, dead or downed trees.

Put the fire out completely before leaving. Remove trash from the ring and scatter the cold ashes at least 75 paces (200 feet) from camp.

Sanitation

Deposit human waste at least 75 paces {200 feet) from water sources or camp and in cat-holes dug 6 to 8 inches deep. Cover and disguise the cat-hole when finished.

Use toilet paper sparingly. Bury it in the cat-hole or pack it out in plastic bags.

To wash dishes or yourself, carry water away from the source and use small amounts of biodegradable soap. Scatter dishwater after all food particles have been removed.

Large parties or long stays may require digging a latrine. Be sure to fill it in and disguise the hole before leaving.

Scour your campsite for trash and evidence of your stay. Pack out all the trash you can, even if it's not yours.

Keep The Wilderness Wild

Let nature's sounds prevail. Avoid loud voices and noises.

Leave pets at home.

Treat our natural heritage with respect. Leave plants, rocks, and historical artifacts where you find them.

APPENDIX F – Seeding Guidelines

Under all of the action alternatives, seeding of native species may be used to assist in the recovery of treatment areas, prevent soil erosion and runoff, and to reduce the potential for non-native invasions. If necessary, non-native plant control would be considered as a follow up action.

The goals of the seeding program is to restore vegetative community structure, density, and species composition similar to conditions that existed prior to grazing and logging; to reduce soil erosion potential; increase biological diversity; and to provide for a variety of mosaic wildlife habitats.

The following table includes the Lake Mead NRA native grass seeding guidelines for vegetation treatment projects in the three major vegetation types.

Table 1. Seeding Guidelines for Native Plants	
Major Vegetation Types	
Juniper:	**Description:** Dominated by juniper, intermixed with pinyon pine, sagebrush and other brush species, minimal grass.
	Site history: Previously dominated by native bunch grasses with scattered and mosaic stands of juniper. Cattle grazing since mid 1800s.
	Impacts: Woody perennials species have encroached and replaced grass sites due to grazing and fire suppression. Most of the juniper is less than 90 years old. Sites are suffering from erosion or are susceptible to undesirable erosion.
	Restoration treatment objectives: Reduce post settlement tree and shrub species and increase native grass cover.
Sagebrush:	**Description:** Dominated by sagebrush intermixed with rabbitbrush and varying amounts of several grass species.
	Site History: Grazing since mid 1800s. Areas previously included more grass and less sagebrush.
	Impacts: Increased soil erosion, lack of biological diversity, brush species has replaced grass dominance.
	Restoration Treatment Objectives: Reduce brush species and increase native grass cover.
Ponderosa Pine:	**Description:** Dominated by ponderosa pine intermixed with juniper, pinion pine, gambel oak, sagebrush and minimal

Table 1. Seeding Guidelines for Native Plants	
Major Vegetation Types	
	grass.
	Site History: Logging operations removed most large old growth ponderosa pine trees from the late 1800s to the 1930s. Excessive grazing since mid 1800s. Aggressive fire suppression has occurred since the early 1900s. Large trees with open, park-like setting with grass understory maintained by frequent wildfires.
	Impacts: Dense even aged stands of ponderosa pine have replaced the open park-like stands after logging ceased. Lacks grass understory due to closed canopy. Other tree and shrub species have encroached into understory due to lack of fires needed for thinning. Remaining old growth trees are threatened by direct competition from increased tree density and from high intensity wildfire fueled by the dense understory.
	Restoration Treatment Objectives: Reduce post settlement trees to densities that more closely represent pre-European settlement conditions (10-50 trees per acre). Increase grass cover.

Seeding Criteria:

Purpose of seeding:

Some treatment areas may be vulnerable to erosion on a short-term basis until vegetation re-establishes. Seeding with desirable species mitigates soil erosion potential and introduces immediate competition with undesirable species establishment.

Sources:

Grass seed collection has been initiated and is being prepared and stored at Lake Mead NRA Plant Nursery. Grass collection from the area will continue on an annual basis however the amounts will be subject to availability of seed and labor. The majority of grass seed will need to be purchased from commercial sources. There are numerous commercial sources and only certified "weed free" seed will be utilized. Purchased seed will be selected from cultivated sources that have similar environmental conditions to our project sites.

Seeding Decision Criteria:

It is recognized that the most desirable site recovery will occur by natural processes and it will usually not be feasible to seed entire project areas. Flat terrain exists throughout much of the Shivwits Plateau, which greatly reduces soil erosion potential. Therefore, drainages and areas with slope will receive the highest priority for seeding to aid recovery in those areas with the greatest erosion potential.

The need for seeding will be evaluated on a project by project and site by site basis. If ample grass exists on site or immediately adjacent to the treatment sites prior to vegetation treatments, then it will not be necessary for supplemental seeding. Experience from previous treatments has shown that existing grass on site increases after burning. Areas that are void of desirable grasses will receive priority for seeding. Due to the high cost of seeding, most seeding operations will target optimal areas for seed germination. The southwest portions of treatment sites will also receive priority for seeding due to the prevailing southwest winds related to seed dispersal. Most seeding will occur during the fall season from September through November. Debris or "vertical mulching" will be utilized when appropriate to accommodate "safe sites" for seed germination.

Methods:
Seed will be dispersed by hand driven "whirlybird" type seed hoppers. Hand raking may follow seeded areas to assist with seedbed preparation. Other methods may include driving an ATV with a mounted seed hopper depending on cultural resource sensitivity of the specific project area. Ariel seeding with planes or helicopters may also be considered but is not likely due to high expense and relatively small project areas.

Species:
Only native species will be included in the seeding projects. Perennial grass species will be the primary focus of seeding projects. All of the species listed below are native perennial grasses that are common throughout all three vegetation types were treatments will occur. Other native species may be considered and the percentage of species mixture will vary according to availability and cost.

Squirreltail *(Elymus elymoides)*
Western Wheatgrass *(Agropyron smithii)*
Blue Grama *(Bouteloua gracilis)*
Sideoats Grama *(Boutoula curtipendula)*
Mat Muhly *(Muhlenbergia richardsonis)*

Low Desert Region of Lake Mead NRA

On the low desert portion of the recreation area, at 6,000 feet elevation or lower, the seeding goals and criteria would be the same as on the Shivwits Plateau. Restoration, including seeding and planting of native species, would be considered after wildfires and exotic species treatment efforts (i.e. spring restoration). Seeds native to the fire area would be utilized as determined appropriate by the NPS restoration specialists. Seeds such as bursage (*Ambroria dumosa*), creosote (*Larrea tridentata*), brittle bush (*Encelia farinosa*), and other species native to the treatment area would be utilized.

In spring restoration, the following native species would be considered depending on the site characteristics.

- **Fremonts cottonwood** (*Populus fremontii*)
- **Gooddings willow** (*Salix gooddingii).*
- **Sandbar willow**
- **Desert willow** (*Chilopsis linearis*)
- **Honey Mesquite** (*Prosopis glandulosa* var. *torreyana*)
- **Screwbean mesquite** (Prosopis pubescens)
- **Catclaw acacia** (*Acacia greggii*)

Native grasses and riparian species would be planted as needed on a case-by-case basis.

APPENDIX G

FIGHTING WILDFIRE IN DESERT TORTOISE HABITAT: CONSIDERATIONS FOR LAND MANAGERS

Timothy Allen Duck, Todd C. Esque, Timothy J. Hughes

Abstract: We describe our experience as biologists/resource advisors working with fire fighting personnel to reduce the risk of impacts and disturbances to desert tortoises and their habitats. Pre-fire season planning is essential preparation for risk assessment and identifying sensitive areas of habitat between biologists/resource advisors and fire managers. Having resource advisors present at the onset of fire operations can prevent potentially destructive activities related to the logistics of having vehicles in habitat and providing for the needs of groups of fire suppression personnel. Rehabilitation of road heads in tortoise habitat is a useful means of deterring further long-term degradation of habitat in some cases. We provide two appendices for use in the field: 1) an outline of fire management activities to be used by the fire managers, and 2) an outline of a shift briefing used to educate firefighters at the scene of a fire. These prescriptions for action and education were developed for use in the northeast Mojave Desert of Utah and Arizona. These procedures are not universal in application and should be tailored to local needs and consideration of other resource values than tortoises. The Sonoran Desert of Arizona differs substantially in physiography, and plant species composition and fuel loads. Therefore, we should consider habitat characteristics and habitat use by tortoises in the Sonoran Desert of Arizona specifically to assess the possible effects of fire suppression activities and to minimize adverse impacts to desert tortoises and their habitats. This approach could be useful for protecting other sensitive species and habitats in a variety of areas.

INTRODUCTION

Wildfires have the potential to drastically alter desert landscapes, reduce the ability of habitats to support wildlife, and kill wildlife directly by exposure to smoke and excessive heat (Humphrey 1974, Stubbs et at. 1985, Simons 1989, O'Leary and Minnich 1981). There are risks to desert tortoises and their habitats associated with fire suppression activities. Vehicles can crush live tortoises or destroy nests and burrows. Vehicles also can create tracks that become trails for off-road vehicle enthusiasts. These potential risks must be considered during fire suppression activities. In interest of conserving habitat for tortoises and other desert wildlife, it is useful to predict years of high fire incidence and prepare resource advisors and firefighters for the special considerations of suppressing fires in tortoise habitat. Through this cooperative approach, between resource advisors and fire suppression personnel, it is possible to reduce risks, to tortoises and their habitats, that may arise from wildfire suppression. The recent listing of the Mojave population of the desert tortoise as a threatened species protected by the Endangered Species Act (USDI Fish and Wildlife Service 1990), and the delineation of critical habitat has created the need for federal agencies to consider the potential impact of fire suppression activities on desert tortoises and their habitats (USDI Fish and Wildlife Service 1994). Policy for fighting wildfires on federal lands in relation to desert tortoises and their habitats has only been considered formally by federal agencies in areas that have special designations such as the desert Tortoise Natural Area in the Mojave Desert of Southern

California (U.S. Bureau of Land Management and California Department of Fish and Game 1988).

Role of Biologists in Fire Suppression

There are two levels of involvement for biologists in fire suppression: as the Resource Advisor (RA) and as a monitor. All official fire operations conducted by federal agencies have a designated Incident Commander (IC). The IC is responsible for all field operations on fires. RA's act as liaison between the IC and the agency manager. The RA provides input directly to the Incident Commander about locations of tortoise habitat in relation to the fire operation, identifies areas that are particularly sensitive to disturbance such as research areas or high density tortoise areas, and provides information to fire fighting personnel about desert tortoise natural history that can be used to minimize further impacts to tortoise populations and their habitats (e.g. how to identify tortoises and their cover sites, where cover sites occur, and what aspects of the habitat are important to tortoises). The RA does not set specific control objectives or determine fire fighting tactics – those are the responsibilities of the IC. It is essential that biologists do not give conflicting orders in potentially dangerous situations and that they work through the chain-of-command. Monitors work directly with fire crews and support personnel to ensure that guidelines are followed and impacts minimized. Monitors may provide shift briefings for fire fighting personnel, survey potential campsites for tortoises or tortoise coversites, and walk in front of fire engines to spot tortoises and other objects of concern. Monitors ensure that tortoises and their habitat are protected from specific suppression actions but do not direct suppression efforts.

Preseason

Fire management begins during the winter when habitat managers meet with fire specialists to develop a fire fighting policy. Objectives and restrictions of fire management are determined. The policy identifies areas of concern such as desert wildlife management areas, research plots, and critical habitat. Levels and methods of fire suppression are addressed. By meeting prior to the fire season, biologists and fire specialists may avoid conflicts associated with fire suppression.

During the pre-fire season meeting fire management personnel develop an understanding of the importance of quick, effective action against fires in desert tortoise habitat, biologists become aware of the tactical and logistical considerations of fire fighting. A tortoise education program and shift briefing are developed and should be tailored to local conditions and needs .

Fire Season

Local fire crews receive a desert tortoise education program during their regular early season fire training. It is crucial that firefighters understand how their actions can impact the environment and how impacts can be reduced. During the fire season biologists are on call and available as resource advisors or monitors on fires. It is a safety requirement that biologists have the necessary protective clothing and equipment in order to be able to go out on the fire line. Biologists may also need to attend fire training to become qualified to work on the fire as a resource advisor.

Fire Suppression

Throughout the year the Fire management officer monitors fuel loads and weather, and accordingly adjusts fire fighting forces and equipment location. Standard suppression techniques were developed for forest fires, therefore some modifications are likely to be appropriate for desert conditions. The Incident Command System (ICS) is the standard management structure used by state and federal agencies (National Wildfire Coordinating Group 1983). It is strictly regimented command and control system, where roles are defined for all participants.

The Incident Commander is responsible for all logistics and operations related to fires. On small fires the IC may be a local fire crew foreman. On larger fires, an incident management team may be brought in to work for the IC. The IC is then responsible for relaying that information (e.g. possibly using the RA or monitor to convey information) and emphasizing its importance to subordinate personnel in the ICS.

Logistics coordinators provide important support services that may impact tortoises and their habitat. The location and design of camps, and any rules of behavior for personnel, are important considerations to reduce impacts to tortoises. Biologists work with Camp Managers to identify camp areas. Campsites should be located outside of desert tortoise habitat, or in locations that are already so disturbed that further use will not cause additional harm to tortoises or the habitat. If it is necessary to establish a camp in desert tortoise habitats the sites should be inventoried for tortoise presence to avoid harm to tortoises. Personnel activities may be contained within these previously disturbed areas and nearby sensitive areas may be designated and delineated as off-limits.

Logistics coordinators also assist suppression efforts with Ground Support. The RA should work with the Ground Support Team to establish rules for vehicle use such as travel restrictions, parking, and speed limits. Drivers are specifically told how to park in relation to the roads and to turn around on desert roads with minimum of off-road impact. In a fire situation, people tend to hurry. By informing fire personnel of the presence of tortoises and driving rules, fewer tortoises may be run over.

The most important suppression activities occur in Operations, where firefighters attempt to halt the spread of the fire. Hand crews are used to build and hold the fire lines, attend to hot spots, and support fire engine crews. Fire engine crews can patrol roads or lay hose along fire lines. If necessary, fire engines may be driven off-road, preceded by a monitor or firefighter on foot to guide the driver of the vehicles around tortoises and other objects of concern. Local units should go off-road first because of their prior knowledge of the area whenever possible.

Desert wildfires can, under high fuel loads or during high winds, move very fast and present difficult control problems. These problems are exacerbated when suppression forces are insufficient to meet the need of controlling the fire. Helicopters can transport personnel into roadless areas, provide a reconnaissance platform, and deliver water from buckets, large, surplus military bomber can be used to drop fire retardant, but they are being replaced by small, single-engine aircraft that can work from dirt landing strips, and reduce turnaround time. Al aircraft landing and fueling areas within habitat must be surveyed and monitored for presence of desert tortoises prior to use to reduce chances of tortoises being killed.

Fire retardant can be important in controlling the spread of fires. There are several options for fire retardant (e.g. foam, water, slurry). A fugitive retardant slurry (FRS) may be preferred over water, foam, or the traditional iron oxide phosphate retardant slurry. FRS can be

more effective than water-chemical reactions, and does not evaporate as easily. Foam is a surfactant (like soap_ that reduces the surface tension of water that is applied on fires. Slurries of iron oxide stain the ground and remain visible in the desert for extended periods of time. At present the effects of theses fire retardant agents on the health of individual desert tortoises are not known. Retardant is most effective when ground crews are available to provide suppression support in keeping the fire from burning through or around the retardant.

Sometimes fire is fought with fire. Under certain conditions, the best and perhaps only opportunity to contain a fire is to set backfires along control lines to remove fuel. Because of the intensity of backfires, the areas where they are attempted can be the most denuded. However, under high wind conditions, or high fuel loads, roads and hand lines may not retard the advance of a fast-moving fire. In some circumstances, backfiring is used to protect larger areas of habitat.

Fires can burn erratically, leaving patches of unburned fuel called islands or fingers. Traditional fire suppression techniques call for the "burning out" of these unburned areas to reduce the chance of the fire flaring up and spreading across control lines. However, in desert habitats these islands and fingers are not as much of a threat as they are in timber fires. Due to their value as undisturbed habitat in largely burned areas we do not allow "burning out" in deserts. These habitat crowns and refugia for tortoises that will eventually re-populate burned areas.

Tracked vehicles may also be used to suppress fires; however, due to their long-lasting impacts on desert soils and vegetation, they are restricted to improving roads or constructing lines where a short distance of line might save a large area from fire. Tracked vehicles have not been used in desert tortoise habitat of the Arizona Strip, Arizona, and Utah since 1980. If used tracked vehicles must be preceded by a qualified monitor.

Post Suppression

Impacts secondary to the fires themselves may continue long after the fire is out (Esque et al. 1994). Roads that were created by fire suppression machinery may open up previously untraveled areas to off-road vehicle enthusiasts. We suggest that fire crews obliterate their track to reduce the temptation of the public to drive down those tracks. In some cases it is possible to re-vegetate the junctions of roads and heavily used fire access trails. Re-vegetation with perennial plants can be expensive; however, by re-vegetating a short distance from the road-head these sources of future disturbances can be hidden from view and therefore less likely to be used (Carolyn Miller – Joshua tree National Monument, pers. Comm).

CONCLUSIONS

The ideas conveyed in this article were developed as guidelines for fighting fires in desert tortoise habitat in the northeast Mojave Desert of Arizona and Utah. We have found these guidelines useful through several fire seasons on the Arizona Strip of northern Arizona and recently in southwestern Utah, but they may not be universal in applications. We stress the importance of tailoring such guidelines for local conditions, and in consideration of other resource values as well as that of the desert tortoise. The physical nature of desert tortoise habitat in the Sonoran Desert of Arizona is very different from that of the Mojave Desert. Because of these differences, many of the stipulations for fire suppression activities may differ in Sonoran habitat of Arizona. Biologists working for land management agencies in the Sonoran

Desert of Arizona should consider habitat characteristics and habitat use by tortoises to assess the possible effects of fire suppression activities and to minimize adverse impacts to desert tortoises and their habitats.

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A Hierarchy for Fire Suppression Activities in Desert Tortoise Habitats.

I. Preseason

A. Resource Manager meets with Desert Tortoise Biologist and Fire management officer (FMO).
   1. Discuss objectives of fire suppression.
   2. Identify areas of concern (e.g. Critical Habitat, Areas of Critical Environmental Concern, Research Study Areas).
   3. Determine level and methods of suppression. Full Suppression of desert wildfire requires quick initial attack by hand crews, fire engines, and aircraft. Plan for sufficient number of crews and fire engines; consider contract helicopter and single engine air tanker.
   4. List key contacts to serve as Resource Advisors (RA), and monitors.
   5. Discuss restrictions on fire suppression.

B. Identify water sources (for aerial water drops by aircraft) and arrange for their use.
C. Identify locations for base camp and staging areas. Survey potential base camp and staging areas for tortoise presence.
D. Determine locations of natural and man-made barriers to fire.
E. Conduct annual road maintenance just prior to fire season improve access and create barriers to fire.
F. Organize an educational package for individuals that will be presenting shift briefings at fires and distribute the packages to appropriate individuals.

II. Fire Season

A. RA's and monitors should be on call 24 hours. These individuals must be trained and issued full protective gear. Training may be on site, prior to the actual fire activity, or the individual may attend a fire seminar.
B. Local fire suppression forces are briefed on desert tortoise considerations for fire suppression during their regular early season fire training. Briefings include a discussion of tortoise ecology, legal status, fire suppression goals and restrictions.
C. Fire Management Officer (FMO) monitors fuel load and weather conditions and adjusts initial attack preparedness level according to fuel and weather.

III. Fire Suppression

A. Fire suppression is a dangerous business. Tortoise considerations are secondary to issues of human safety. Fire organization adheres to a strict chain-of-command. The resource advisor helps define goals and objectives for fire suppression efforts and informs the Incident Command (IC) of any restrictions, but does not get involved in specific suppression tactics. Tortoise biologists/monitors ensure that tortoises and shelter sites are protected/avoided but do not give specific directions on locations of lines. On small fires the IC may be a local fire crew foreman. For example, some areas have determined that the cutoff when further personnel are called in is 10 acres (BLM – Dixie Resource Area, Unpublished fire plan).
B. It is important that biologists not interfere in fire suppression operations. RA's/monitors are a resource to provide input and assistance/ if tortoise

considerations are not being observed, issues are discussed with IC and FMO. It would be inappropriate and counter productive for the RA's to give conflicting orders.

C. Small fires should be handled by local forces.
D. For more complex fires, an organized fire management team is brought in. The IC should be informed by the RA that tortoise considerations have high priority. IC relays through subordinates the importance of following guidelines provided by RA. RA makes an awareness presentation at shift briefings.
E. IC and RA evaluate suppression resources, tortoise habitat and population considerations. After considering these factors, IC develops a plan fir fire suppression.
F. Hand crews should be used to build and defend fire lines. Engines can be used for support from roads. Wherever practical, fire engines remain on roads and lay fire hose along hand lines. If fire engines need to go off-road then they must have a crew person or monitor walking in front of engine to avoid tortoises and shelter sites. Use local units to go off road first.
G. Hot fires may require aerial support from helicopters or fixed-wing aircraft using slurry (fugitive retardant most preferred, iron oxide least preferred), foam, or water retardants.
H. If it appears that it may be necessary to use tracked vehicles then order and stage them at a site previously cleared by the RA/monitor - heavy equipment should be used as a last resort and optimized where a short distance of fire line will prevent large area from burning. Tracked vehicles must be accompanied by qualified RA/monitor.
I. Backfires can be used from roads or lines where necessary. Fingers, or islands of unburned habitat must not be burned out as a fire suppression measure. Scratch lines should be patrolled.

IV. Post Suppression

A. Notify appropriate agencies of damage or injury to desert tortoises or tortoise habitats.
B. Begin rehabilitation of fire lines, especially lines created by tracked vehicles. Obliterate vehicle tracks that leave roads to prevent those tracks from becoming trails and roads.
C. Begin consideration of any rehabilitation of burned area that may be necessary (e.g. seeding, perennial plantings).
D. Begin vegetation monitoring where appropriate. Establish paired plots inside/outside burn.
E. Conduct post-fire critique. Evaluate effectiveness of suppression activities and identify successes and failures of desert tortoise mitigation efforts. Revise procedures as necessary.

Desert Tortoise Mitigation Requirements for Fire Management Activities

1. All personnel on the fire shall be informed and educated about desert tortoises and the importance of protecting habitat and minimizing take. Fire crews shall be briefed on the desert tortoise.
2. Fire-related vehicles shall drive slow enough to ensure that tortoises on the roads can be identified and avoided.
3. Resource Advisors shall be designated to coordinate desert tortoise and other resource concerns and serve as a liaison between the Area Manager and the Incident Commander. Monitors shall be designated to monitor fire suppression activities; to ensure protective measures endorsed by the Incident Commander are implemented; to survey prospective campsites, aircraft landing and fueling sites; and to perform other duties necessary to ensure adverse effects to desert tortoises and their habitat are minimized. Resource Advisors and monitors shall be on call 24 hours during the fire season.
4. Off-road vehicle activity shall be kept to a minimum. Vehicles will be parked as close to roads as possible, and vehicles shall use wide spots in roads to turn around. If off-road travel is necessary, a biologist or crew-person shall walk in front of the vehicle to direct the driver around tortoises and tortoise burrows. Whenever possible, local fire-fighting units should go off-road first because of their prior knowledge of the area.
5. Prior to moving a vehicle, personnel shall inspect under the vehicle for tortoises.
6. Campsites should located outside of desert tortoise habitat, or in locations that are previously disturbed. If camps are located in desert tortoise habitat, surveys of the site should be conducted.
7. All aircraft landing and fueling areas within desert tortoise habitat must be surveyed and monitored for presence of desert tortoise prior to use to reduce chances of tortoises being killed.
8. Use of tracked vehicles in desert tortoise habitat shall be restricted to improving roads or constructing lines where a short distance of line might save a large area from fire. Monitors shall walk in front of tracked vehicles to ensure minimal impacts to tortoises and their burrows. Equipment staging areas shall be surveyed for desert tortoises prior to use.
9. Fingers or patches of unburned vegetation within burned areas shall not be burned out as a fire suppression measure.
10. Fire crews shall, to the extent possible, obliterate vehicle tracks made during the fire especially those of tracked vehicles.
11. Rehabilitation of the burned areas shall be considered, including seeding, planting of perennial species, etc.
12. Recovery of vegetation shall be monitored, including establishment and monitoring of paired plots, inside and outside of the burned area.
13. The effectiveness of suppression activities and desert tortoise mitigation measures shall be evaluated after a fire. Procedures shall be revised as needed.

Direct Effects

Direct effects are probably the most troublesome, if not misunderstood, of the fire impacts to the cultural resources manager. This is due to the fact that, everything being equal, all cultural resources within a given burn unit have the potential to be exposed to fire, and that our understanding of the effects of fire on stone, metal, bone, wood and other common materials is not yet satisfactory.

Generally, the more severe the fire behavior, the greater the potential for adverse impacts to the cultural resource record. Not all materials comprising cultural resources are equally susceptible to the direct effects of fire (e.g., wood versus stone). This holds true even within single material classes. It is necessary to explore separately what is known of the effects of fire on the materials that commonly comprise the cultural resources at Lake Mead NRA.

Flaked Stone

Flaked stone artifacts at Lake Mead NRA generally occur as formed tools and debitage. The most common raw materials represented include cryptocrystalline silicates, fine to coarse-grained igneous, metamorphic and sedimentary rocks, and obsidian. A number of studies throughout southern Nevada have demonstrated the value of certain flaked stone tools as time-markers, projectile points in particular, for building local and regional chronologies. Likewise, debitage analysis can provide information about technology, adaptation, ethnicity, mobility and other matters.

Experiments have demonstrated that flaked stone artifacts are vulnerable to structural modifications such as breakage, melting, discoloring, and weight loss as a result of heat from fire (Deal 2001). The vulnerability of a given flaked stone artifact relates to the material from which it is made. For example, cryptocrystalline silicates have been documented to crack, spall, and shatter at 350° C. While not particularly common in archeological sites at Lake Mead NRA, obsidian artifacts have the potential benefit of dating through measurement of the obsidian hydration rind. Studies have demonstrated that hydration rinds are subject to elimination or distortion when exposed to temperatures above 100 to 200° C. It is well documented that certain raw materials, cryptocrystalline silicates in particular, were heated prior to working to improve flaking qualities. Physical changes to the raw materials such as color changes and spalling resulting from such heat treatments can also occur during modern fires.

Groundstone

Groundstone artifacts, including bedrock mortars and milling slicks, portable mortars, pestles, millingstones, handstones, ornaments and other varieties, occur in a number of contexts at Lake Mead NRA. Basalt and sandstone are the most common raw materials.
Few data are available on the effects of fire on groundstone artifacts (Deal 2001). Artifacts observed after low intensity fires tend to have minimal surface defects, while those that undergo high severity heating often exhibit breakage, cracking, oxidation, sooting and adhesions. Again,

the degree of damage appears to correlate with the raw material, with harder volcanic rocks being more durable than sandstone and quartzite.

Native American Ceramics

Native American ceramics frequently occur on late prehistoric and ethnographic archeological sites within Lake Mead NRA. These range from decorated vessels associated with ancestral Puebloan occupations, to Brownware ceramics deposited by the Southern Paiute.

Laboratory experiments conducted by Bennett and Kunzmann (1985) on pottery sherds of slipped and decorated, undecorated and corrugated types suggested that the physical integrity of the specimens remained largely intact at temperatures below about 400° C. They further suggested that the susceptibility of pottery sherds to structural damage was related largely to the mineralogy of the clay(s), accessory minerals present in clay(s) or temper, firing temperature and atmosphere, and what salts had impregnated the pottery since it was used. Most earthenware pottery has a minimum firing temperature of about 600° C, and when vessels or sherds are exposed to temperatures that exceed this number, the clay body will become denser. With increased temperatures, the clay may begin to melt. The temperature at which clay will melt depends largely on the type of clay and mineral composition; those clays with sodium and potassium salts tend to have low melting temperatures. Earthenware pottery fired at 600° C was felt to have a melting point of about 900 to 1100° C.

Bennett and Kunzmann (1985) further suggested that pottery color was far more susceptible to alteration from heat than physical structure. For example, redware heated to a temperature of 500° C in an oxidizing atmosphere can shift to a darker shade. Whiteware heated for prolonged time in an oxidizing atmosphere often assumes a slightly buff color due to alteration of the iron minerals often found in clays, and temperatures above 600° C will turn most whiteware to redware. Pottery decorations incorporating mineral paints are highly resistant to heat damage, whereas organic paints will turn black, and can burn away at temperatures above 350° C.

A number of post-burn observations have been made on Native American ceramics recovered from archaeological sites in the American Southwest. Gaunt and Lentz (1996) found that 47.5% of ceramic artifacts from sites burned during the Henry Fire were fire-altered to some extent, including sooting, spalling, oxidation, loss or alteration of pigment, adhesions and crackled slip. Pottery from sites exposed to moderate and high intensity fire exhibited the most damage. In particular, damage was most acute in areas where logs had burned, with impacts occurring in both surficial and shallowly buried (<20 cm.) artifacts. Some of the sherds exhibited surface alterations to the extent that proper classification was only possible once the artifacts had been processed in the laboratory. Concern was also expressed that although some alterations could be primarily cosmetic and/or temporary, long-term artifact preservation could be compromised.

Traylor et al. (1990) reported similar results on ceramics from sites investigated following the La Mesa Fire. Damage was restricted to those sherds on the ground surface, and included oxidizing, carbonizing, adhesions, body and core color changes, and perhaps reduced structural integrity. However, despite blackening most of the sherds were readily identifiable in the field. Jones and Euler (1986) subjected a number of heavily sooted pottery sherds to cleaning (water and dilute hydrochloric acid) in the laboratory and had limited success reviving the original appearance.

Jones and Euler (1986) speculated, however, that because none of a multitude of sherds from unburned sites in the same area exhibited comparable blackening, the condition must be temporary.

Native American Architectural Remains

Example of Native American architectural remains occur in various areas of Lake Mead NRA. Most of these are stone walls and foundations associated with ancestral Puebloan occupations. Wooden "Wickiup" structures related to Southern Paiute occupations may also be present.

Post-wildfire observations of fire-effects on architectural features revealed definite vulnerability to direct fire effects. Welded tuff and sandstone blocks associated with masonry structures burned over at Mesa Verde and Bandelier national monuments exhibited spalling, discoloration, cracking, and disintegration (Lissoway and Propper 1988; Traylor et al. 1990; Willmer 1996). The most notable damage was observed on sites that experienced severe fire behavior. Fire damage is believed to be a catalyst for hastening the decomposition of stone blocks, with the implication that erosion could severely damage or completely destroy the integrity of this portion of the site. Damage seems to be largely restricted to those blocks located on or very close to the ground surface. Interestingly, Jones and Euler (1986) suggested that under low intensity fire conditions, masonry rubble might actually preclude fire from entering the interior of rooms.

In certain contexts, flammable and/or highly degradable elements like wooden beams and jacal are actually preserved in the archeological record. These would be particularly vulnerable to fire damage. Fiero (1991:5) documented the destruction of a wooden wall peg during the Long Mesa Fire.

Direct fire damage to architectural remains and their contents can be exacerbated by the presence of standing or fallen trees within or in close proximity to these features. For example, Willmer (1996) found the greatest amount of damage in tuff blocks to have occurred in areas where fallen logs lay on top of these remains.

Shell

Marine and freshwater shell can potentially occur in Native American (e.g., beads and ornaments, faunal remains) and historical (buttons, faunal remains) archeological contexts at Lake Mead NRA.

Waselkov (1987) suggested that shell heated to a high temperature will begin to deteriorate as release calcium oxide mixes with sodium bicarbonate solution found in the soil. Seabloom et al. (1991) found that shell exposed on the surface during a grass fire fractured or disintegrated. Haecker (2000) exposed a shell button and whole oyster shell to relatively low (ca. 245° C) and high (ca. 815° C) intensity fires. In the first, the shell button discolored and the oyster shell remained unchanged, while in the second, the shell button had completely disintegrated, and the oyster shell discolored slightly.

It is important to note that shell beads and ornaments were sometimes intentionally heated or burned in anticipation of manufacture and/or prior to deposition. These may exhibit color and/or

physical changes that reflect both cultural behavior and greater vulnerability to subsequent heat exposure.

Bone

Archeological bone specimens occur in the form of culinary remains, formed tools and human remains at Lake Mead NRA. Faunal remains provide valuable information in regard to both human adaptations and past environmental conditions. Likewise, human remains have the potential to yield direct evidence of the nature of human adaptations, health and disease, and demography, to name just a few.

Various forms of damage (water loss, charring, chemical alterations) have been documented on bone in laboratory experiments between temperatures of 100 and 1000° C (Bennett and Kunzmann 1985; Nicholson 1993; Bennett 1999). Experiments performed by Stiner et al. (1995) demonstrated that burned bones are more fragile and brittle than unburned specimens, and that mechanical strength is negatively correlated with the extent and intensity of burning. Bone fragmentation was particularly acute in burned specimens subjected to post-burn trampling. Again, archeological bone was often heated in the context of meal preparation and other activities.

Pollen and Archaeobotanical Remains

A number of archeological and paleoenvironmental studies in southern Nevada have reported on the recovery and analysis of pollen and archaeobotanical remains, the preservation of which is generally good due to the dry climatic conditions. These materials comprise a potentially important means of reconstructing human adaptations and past environmental conditions in the region.

Fire effects on pollen are not well understood. Scott (1990) suggested that surface pollen was destroyed by moderately high intensity fire behavior, while subsurface pollen was relatively unaffected. Fish (1990), however, found that surface pollen, although physically altered, was still readily identifiable following a wildfire. The effects of fire on phytoliths is unknown.

Unless found in unique depositional contexts (e.g., caves and rockshelters), macrofloral remains such as seed and bulb fragments are unlikely to be preserved in archeological contexts unless carbonized (Micsicek 1987). Complete carbonization of plant materials occurs between temperatures of 250 to 500° C in low oxygen conditions. Carbonized plant remains are very resistant to further organic decay, often succumbing to nothing less than mechanical damage. Accordingly, Ford (1990) noted no apparent damage to botanical remains recovered from shallow fire hearths in sites burned during a wildfire. However, other archeobotanical studies found the distinction between modern and archeological charcoal to be far less apparent. This phenomenon could be of concern with regard to the contamination of archeological features with modern carbon.

Fibers and Hides

Fibers such as basketry and textile fragments, and animal hides typically occur only in very specialized contexts such as dry caves. These materials are highly susceptible to fire at even very low intensities.

Rock Imagery and Spiritual Sites

Spectacular examples of rock imagery sites occur at Lake Mead NRA and the surrounding region, and Native American spiritual sites have been documented as well.

Kelly and McCarthy (2001:170) noted that rock imagery panels are highly vulnerable to direct fire impacts including discoloration, soot smudging, rock face spalling, and heat penetration that alters organic binder materials of pictographic elements. Extreme examples of damage have been documented in conjunction with low humidity, heavy fuel loads, hot and dry weather, and erratic winds.

Direct impacts to spiritual sites are less obvious. In the case of tangible resources, potential damage might include spalling and cracking. Less apparent to most cultural resources managers are the effects fire might have on the spiritual significance of a particular site or location to contemporary Native Americans. Another apprehension with these areas is the presence of fire and other personnel in the vicinity of spiritual sites.

Organic Residues

Organic residues that adhere to or are absorbed by artifacts, ecofacts, and features are the subjects of increasingly sophisticated lines of inquiry (Heron and Evershed 1993; Orna 1996). Among the residues commonly studied include lipids, proteins, carbohydrates, and other biopolymers. Artifacts from Lake Mead NRA almost certainly retain some of these signatures.

Heron and Evershed (1993) noted that certain residues are prone to elimination through pre- or post-depositional disturbance, including heating, although that aspect is poorly understood in archeological contexts. More recently, controlled experiments have yielded useful information. For example, based on an analysis of cooking pot residues, Malainey et al. (1999) found that fatty acid composition of plant and animal foods changed dramatically with thermal and oxidative degradation, rendering accurate interpretations difficult. Still, Newman (1995) reported positive immunological reactions on flaked stone artifacts recovered from sites in an area subjected to a high intensity wildfire.

Historical Materials

A variety of historical artifacts and features, including glass, metal, wood, ceramic, brick, cement, cinder block, leather, rubber, and plastic, are known or suspected to occur on historical archeological sites, structures, and cultural landscapes within the Lake Mead NRA. These materials vary widely in their susceptibility to direct fire effects.

Heat build-up, smoke, and flames can all impact glass artifacts and fragments (Haecker 2000:7-9). Soda lime glass, commonly used for containers, windows, pressed and brown-ware and lighting products, has a melting temperature of about 540° C, while lead glasses melt at 420° C.

Crazing, or cracking of glass into smaller, irregular segments, is a common impact associated with exposure to heat, though the degree of effects is related to the type and thickness of the glass, temperature, and distance from the point of origin.

Haecker (2000:10-12) noted that certain metals may actually melt prior to reaching their melting points (Table 1) through the process of alloying where a metal with a lower melting point drips onto one with a higher melting temperature, the resulting reaction lowering the melting temperature of the latter. Metal artifacts that do not melt may warp out of shape under certain conditions.

Table 1
Melting Points of Metal Materials Commonly
Found on Historical Archeological Sites

Material	Temperature (°C)	Artifacts
Aluminum	660	Kitchenwares
Brass (yellow)	932	Cartridge cases, military buttons and insignia
Cast iron	1,350 to 1,400	Kettles, Dutch ovens, wood stoves
Copper	1,082	Kitchenwares, building materials, coins
Gold	1,063	Coins, jewelry
Iron	1,540	Tools, nails, horseshoes, cans, corrugated roofing
Lead	327	Bullets
Nickel	1,455	Plating
Pot metal	300 to 400	Flatware, pots, faucets
Silver	960	Coins, jewelry
Solder (tin)	135 to 177	Patch repair on brass and iron objects
Steel (stainless)	1,427	Eating utensils, kitchenwares
Steel (carbon)	1,516	Heavy machinery parts
Tin	232	Kitchenwares, toys, building materials
White pot metal	300 to 400	Kitchenwares
Zinc	375	Plating for iron objects

Adapted from Haecker (2000).

Haecker (2000) noted that many historical metal artifacts and features have previously been subjected to the effects of fire through trash burning, structure fires, etc. While many of these were probably not of sufficient temperature to adversely damage metal artifacts, certain components (e.g., lead solder in cans) may have melted, causing a loss of structural integrity and hastening disintegration. Likewise enamel and plating (such as tin, brass and silver) can burn or spall off, exposing the underlying metal to oxidation. Even heavy-duty metals, such as iron and steel, are subject to pitting and other surface damage that can result in long-term attrition.

Potential direct fire effects on historical ceramics are dictated by the characteristics of the paste, glaze, painted decorations, as well as the temperature to which the artifact is exposed (Haecker 2000). Refined (i.e., glazed) earthenwares (e.g., ironstone, hotel wares) will crack and become discolored at even relatively low temperatures. Porcelains have a melting temperature of about 1,550° C, although overglaze paint decorations and makers marks can become discolored and/or eliminated, thereby potentially compromising the ability to accurately identify and/or date the artifact.

Haecker (2000) noted that the rate of wood charring, the carbonization of a fuel by heat or burning, varies widely depending on a number of factors. Typically, a section of dimensional lumber will ignite at about 350° C. Haecker (2000) further noted that wood occurring in historical archeological contexts is particularly susceptible to even low-intensity burning because it is often highly decomposed due to weathering and located in close proximity to other highly flammable materials (e.g., thick vegetation, accelerrents).

Haecker (2000) suggested that porous firebrick is highly susceptible to fire, and that cinder block, certain masonry surfaces, and cement mortar could spall when exposed to fire. Experimental heating performed on gypsum plaster, fire brick, and cement mortar revealed varying effects depending on fire temperature. At about 245° C, the firebrick and cement mortar were unchanged, and the gypsum plaster was discolored and friable. The firebrick discolored and broke, gypsum plaster became even more friable, and the cement mortar discolored at temperatures exceeding 650° C.

Rubber and rubberized artifacts are completely consumed in low intensity fires, while plastics melt between 75 and 265° C (Haecker 2000). With age, leather objects dry and become brittle and will char in a low intensity fire and be consumed at higher temperatures.

Operational Effects

Although generally thought of as being associated only with wildfires, operational effects can also occur in conjunction with prescribed burns and wildland fires for resource benefits. In general, a tremendous amount of potentially damaging activity is involved in the implementation, control and/or suppression of wildland fires (Pyne et al. 1996).

Fire Lines

Fire lines are breaks in fuel continuity intended to prevent the spread of fire. These can be natural features (e.g., bodies of water, rock outcrops), constructed features (e.g., hand line, dozer line, wet line), or a combination of the two. Fire lines are often constructed during the suppression of wildfires, and in anticipation of prescribed burns.

Fire line construction at Lake Mead NRA emphasizes the use of Minimum Impact Suppression Techniques (MIST). To the extent possible, prescribed burn unit boundaries on the Shivwits Plateau are comprised of roads and natural fuel breaks. Constructed hand lines are generally no more than three feet in width. Fire lines constructed in association with wildfire suppression in the lower desert areas at Lake Mead NRA are usually “scratch lines” between six and 12 inches wide. Unless authorized by the Superintendent, the use of heavy equipment is prohibited.

Ground disturbance is the primary impact associated with fire line construction. This can involve soil displacement that occurs while cutting the fire line to mineral soils, and soil displacement resulting from the felling of trees and removal of other vegetation. The scale of soil disturbance during fire line construction is strongly related to the tools employed (as well as the nature of the local fuels). Generally speaking, a line constructed with hand tools will result in less soil displacement than one built with bulldozers. Accordingly, severe damage has been documented on archeological sites intersected by dozer lines (Traylor et al. 1990; Wettstaed and LaPoint 1990; Wettstaed 1993). Still, construction of fire lines with hand tools can also have an adverse effect on site integrity (Keefe et al. 1999). Fire line construction and use can also result in soil compaction that leads to increased surface runoff and erosion. Unless properly rehabilitated, fire lines can be attractive paths for individuals to commit intentional or unintentional resource damage.

Depending on conditions, these lines are constructed in order to attain *direct* control of the fire (containing it to extinguishment), or *indirect* control (securing the perimeter of the burn from strategic boundaries). Potential advantages of the former include minimization of fire size and immediate control, while poor control over line placement is the principal drawback. Indirect control results in less line construction and better control over line location, but allows for a larger fire.

Staging

Staging occurs in prescribed, wildland fire for resource benefit and wildfire contexts. Staging involves the distribution of people and equipment before, during and after the fire event.

In prescribed burns, the number of personnel and equipment is usually fairly low compared to wildfires, and not always positively correlated with the size of the burn unit. Rather, the complexity of the burn and proximity the burn unit to developments and other important resources generally dictates the amount of support required. Staging in prescribed burn units located close to developed areas often occurs in previously disturbed areas such as roads, parking lots, and pullouts. Vehicles are parked in these areas, and equipment, such as hoses and drip torches, is readied. Ground disturbances, though usually very shallow, can result in these areas. Staging of all-terrain vehicles, equipment and personnel will also take place on constructed fire lines, and these are also used to access various portions of a burn unit.

In more remote locations, established trails often function as access and travel corridors to and within a burn unit. Spike camps might be placed at established backcountry camps, or new ones created at optimal places. Ground disturbances might include increased foot traffic, and the excavation of latrines and pits for gray water disposal. A heli-spot or drop spot is often located nearby, and these will be constructed (by clearing vegetation) if necessary. Staging requirements are generally similar for wildland fire for resource benefits.

Staging under wildfire conditions, however, is frequently more complex owing to the frequently urgent nature, larger numbers of personnel and greater variety of equipment. While vehicles and other equipment are often driven and parked in designated and/or previously disturbed areas, the sheer number can lead to a greater potential for resource damage. Personnel are generally

housed at large temporary base camps. These are often located a substantial distance from the actual fire, and usually in developed areas like campgrounds and large parking lots. Spike camps are established on the margins of the burn, and are utilized by field personnel which, on large conflagrations, can number in the hundreds. If no suitable areas exist, one or more heli-spots and drop locations will be constructed. In the absence of vegetation-free areas, safety zones are sometimes constructed along the perimeter of the wildfire. They are used by fire fighting personnel in the event of extreme fire behavior. Safety zones can be substantial in size (hundreds of square meters) and will be cleared of all standing and ground fuels with hand tools.

Disturbances associated with staging vary between prescribed burns, wildland fire for resource benefits, and wildfires. In general, not only is the amount of ground disturbance higher in wildfire situations, the locations chosen for heli-spots, spike camps and safety zones are often made with little advanced planning or notice. Substantial ground disturbance can occur as a result of heavy equipment operations, while such impacts tend to be largely restricted to the surface when only hand tools are employed.

Ignition Techniques

A variety of ignition patterns are employed when conducting prescribed burns and suppressing wildfires (Pyne et al. 1996), all of which have implications for archeological resources. Heading fires are those with a front line spreading or set to spread with the wind or upslope. Heading fires are generally ignited in spots or strips and allowed to spread. These fires are rapid, inexpensive and result in good smoke dispersal, but result in a high intensity fire with high spotting potential. Backing fires are ignited along a baseline (e.g., fire line, road, stream) and allowed to back into the wind or downslope. Spot and strip ignition patterns can also be employed with backing fires. Backing fires are generally low intensity, have slow spotting potential, and spread slowly. Flanking fires are used to treat an area with lines of fire set directly into the wind. Multiple individuals ignite strips that form a series of widening triangles, or chevron. Flanking fires provide a means of keeping flame heights between those of heading and backing fires, but require a lot of coordination to safely implement. Finally, center or ring fires involve the ignition of the center of the burn area, followed by concentric rings of fire surrounding the central point. This method is rapid, has excellent smoke dispersal, burns at a high intensity in heavy fuels, and is susceptible to long distance spotting.

Insofar as fire intensity and rate of spread may influence the direct impact of fire on cultural resources (as discussed above), consideration of the method of firing is very important. However, the modes of ignition should be considered as well. Ground and aerial ignition are the most common forms of ignition used Lake Mead NRA. Ground ignition is accomplished through the use of fusees and drip torches, with one or more individuals involved in firing operations. Aerial ignition sources include plastic sphere dispensers and heli-torches. The latter deposits super-heated gelled fuel, and could impact vulnerable cultural resources on contact.

Often both hand and aerial ignition are utilized during prescribed burns. For example, the boundaries of a unit will be secured with hand ignition, followed by aerial ignition of the interior portion. As noted, heading fires and center or ring fires carry the potential for long distance spotting, comprising a potential threat to cultural resources located downwind.

Fire Retardants

Several types of fire retardants have seen use during prescribed and wildfires. These fall into two general groups-physical agents and chemical agents (Pyne et al. 1996). The former influence heat and diffusion processes, whereas the latter affect fuels by modifying the course of combustion. Physical agents, such as water and dirt, typically provide short-term protection against combustion. Typically water is combined with additives that either reduce surface tension (i.e., wetting agents) that allow treated water to penetrate deeply into combustible material, or increase water viscosity (i.e., thickening agents) so that treated water congeals on the surface of fuels. The latter is considered particularly effective, and often delivered by aircraft as a gel or slurry. Chemical agents afford long-term protection, and are also generally applied as slurries. Fire retardants have been successfully used to protect archaeological resources from the direct effects of fire.

The operational effects of fire retardants on cultural resources relate to their application and composition. Backback pumps, fire hoses, and aircraft are often used to apply fire retardants. Romme et al. (1993) speculated that slurry or water dropped from aircraft could topple standing walls of prehistoric structures, and the same could probably be said of wooden historical features. Likewise, high elevation retardant drops could also impact midden deposits and artifact scatters. Some fire retardants are corrosive and/or toxic. The former is a concern in regard to the application of foams, gels and slurries on cultural resources such as historical structures and features.

Mop-Up and Rehabilitation

Mop-up and rehabilitation occur once a fire has been declared controlled and out, respectively. These are carried out most often following wildfires. Some mop-up and rehabilitation may take place after prescribed burns or wildland fire for resource benefits. Depending on circumstances, mop-up varies from a concerted effort to extinguish all combustion through intensive hand labor to ground patrol to aerial reconnaissance. The aggressive approach can be particularly detrimental to cultural resources. This involves extensive ground disturbance through the use of hand tools, hazard tree felling, and hose work. In forested areas, smoldering tree roots and stumps are often excavated and broken up.

Wettstaed (1993; Wettstaed and LaPoint 1990) described heavy damage to an archeological site resulting from mop-up activities, including extensive subsurface disturbance and artifact breakage caused by tool blows. Traylor et al. (1990) found that mop-up following the La Mesa Fire produced surprisingly little damage to archeological resources, and none to architectural remains.

Rehabilitation involves reconditioning fire lines and other disturbed areas, stabilizing volatile landforms, and controlling runoff. This is accomplished using a combination of hand tools, heavy machinery, and aircraft. Fire line rehabilitation associated with prescribed burns is often as simple as pulling back (with hand tools) the berm adjacent to the scratched line and perhaps disguising the course by scattering cut vegetation. On larger fire lines, such as those constructed by bulldozers, heavy equipment is often needed to correct the damage. Wettstaed (1993; Wettstaed and LaPoint 1990) suggested that rehabilitation in these instances could result in significant, if unrecognized, damage to cultural resources. For example, rehabilitation of a fire

line that passes through an archeological site will return artifacts to the footprint of the line, but out of original context. Given enough time, it might prove difficult to identify any previous impacts, especially if the lines were not mapped. Traylor et al. (1990) reported similar woes from rehabilitation following the La Mesa Fire, and the restoration of bulldozer lines in particular.

Emergency measures are often employed after wildfires to stabilize hillslopes, stream channels and roads (Robichaud et al. 2000; USDA and DOI 2001a, 2001b). As described in greater detail below, extensive research documents that surface runoff and erosion can increase markedly following a large, moderate to high intensity wildland fire. Some of these stabilization techniques might require the use of heavy equipment and will result in extensive disturbances.

Looting

Looting is a threat to cultural resources during and following prescribed burns, wildland fire for resource benefits, and wildfires. A major dilemma for cultural resource managers is the disclosure of sensitive information to fire personnel; on one hand, people need to know where and what resources to protect and/or avoid them, but on the other, it opens the door for inadvertent and malicious damage. In locations where cultural resource density is high, such as the American Southwest, it is nearly impossible to suppress a wildfire or conduct a managed fire without communication between fire and cultural resources management personnel in order to prevent resource damage.

Traylor et al. (1990) found surface artifact collecting to be a common phenomenon during the La Mesa Fire, and that fire personnel were often unaware of laws against collecting. However, it was also noted that fire personnel were extremely receptive to educational messages provided by archeologists associated with the event.

Indirect Effects

Indirect fire effects are a potential threat to archeological resources following all prescribed and wildland fires. These can occur during, immediately following, or long after a fire event. Only those indirect effects considered the greatest threats to the cultural resources at Lake Mead NRA are considered below.

Increased Surface Runoff and Erosion

As noted, research indicates that surface runoff and erosion can increase markedly following a fire (Robichaud et al. 2000). Under good hydrological conditions (>75 percent of ground surface covered with vegetation and litter), only about two percent or less of rainfall becomes surface runoff and erosion is low. Severe disturbances, such as large, moderate to high intensity fires, can render poor hydrological conditions (<10 percent of ground surface covered with vegetation and litter), the result being up to a 70 percent and 300 percent increase in surface runoff and erosion, respectively. These effects can be particularly acute and wide-ranging if the fire is closely followed by precipitation. A water-repellent hydrophobic layer sometimes forms on the ground surface following a fire, exacerbating the impact of even moderate rainfall. Under such conditions, even raindrops become agents of localized changed. While surface runoff and erosion will dissipate with the return of vegetation, recovery can be slow (order of decades)

following severe fires and/or in xeric vegetation communities. In the case of Lake Mead NRA, creosote and bursage are often slow to return following fires, and, following decades of overgrazing, necessary native grass seed is often lacking from post-burn forests and shrublands.

Under the right topographic, soil type, and climatic conditions, increased surface runoff can lead to dramatically higher stream peakflows and sediment delivery. Higher stream peakflows generally lead to higher stream levels, one consequence being elevated erosion rates on landforms adjacent to the streambed. These localities tend to support the highest density of prehistoric and, in some cases, historical archeological resources, the integrity of which are threatened during high water events.

Soil loss resulting from surface erosion degrades water quality, alters geomorphological and hydrological characteristics, and reduces site productivity. Along with this, the spatial integrity of archeological resources is threatened, particularly those located on or adjacent to slopes. Experimental studies and field observations attest to the combination of sheet erosion (induced by water, wind and other phenomenon) and gravity as an effective conveyor of artifacts and ecofacts (Rick 1976; Schiffer 1987). Following extensive wildfires in Montana, Wettstaed (1993; Wettstaed and LaPoint 1990) found that a localized heavy downpour produced a puddling effect on one site, concentrating flaked stone debitage into pools that might later be mistaken for reduction loci.

Increased Tree Mortality

Trees can perish during fires due to tissue damage resulting from exposure to heat (Miller 2000:9-16). In some cases, trees are killed outright, in others individuals are weakened and succumb to disease and insects. The susceptibility to fire mortality and injury varies by species; for example, ponderosa pine is highly resistant, while western juniper is highly vulnerable.

While tree mortality is an inevitable process, fire, in combination with other factors, can lead to rates that exceed those believed to be "natural." Long-term research conducted in prescribed burn units in mixed conifer and Sequoia groves in the southern Sierra Nevada showed that tree density declined 40 percent one year following a prescribed burn, and reached nearly 50 percent after ten years (Keifer 1998).

The implications of high tree mortality are several. Trees killed outright or severely weakened by fire are very susceptible to falling over. Those located within or adjacent to cultural resources could do severe damage by dislodging materials found in or around the root wad, or artifacts and features can be crushed or disturbed by the main trunk or larger branches. Likewise, branches can also be driven deeply into the soil as the tree strikes the ground, potentially impacting subsurface archeological components. Finally, fallen trees comprise heavy fuels that will burn at extreme temperatures during a future fire event.

It is important to note that tree mortality impacts are of particular concern at the present time since large tracts of forested land in Lake Mead NRA have not seen fire in several decades. As a result, tree densities are high, and duff and woody fuel loads are extreme. Inevitably, prescribed or wildland fire in these areas will result in high tree mortality.

Increased Burrowing Rodent and Insect Populations

The affect of burrowing rodents and insects on the integrity of subsurface archeological resources is often under appreciated. Among the burrowing mammals found at Lake Mead NRA are kangaroo rats, mice, ground squirrels, badgers, kit foxes, and coyotes.

Research suggests that the populations of burrowing rodents will increase following prescribed and wildland fires (Lyon et al. 2000a). Rodent populations often remain high after the fire because the animals are protected within burrows. The quantity of preferred forage is also enhanced by fire in most habitats, again promoting high survivorship and increased populations (Lyon et al. 2000b). Accordingly, populations of rodent predators such as coyotes will also increase, and these species can also disturb significant amounts of soil in the quest for prey.

Carbon Contamination

The contamination of archeological sites and features with non-cultural carbonized botanical remains is an issue of major concern. In the context of radiocarbon dating, submission of recent charcoal would yield an erroneously late determination. In terms of the reconstruction of economic systems and paleoenvironments, introduction of recently burned plant remains like pine nut hulls and grass seeds could result in misleading interpretations.

Archaeologists have become far more cognizant of the integrity of charcoal assays submitted for radiocarbon analysis. Schiffer (1986) pointed to the "old wood problem," the submission of conventional radiocarbon samples obtained from charcoal that is far older than the actual episode of occupation (e.g., recycling of wooden beams in architecture of the American Southwest, use of driftwood as firewood), as a potentially serious problem. The advent of AMS dating provided archeologists with an opportunity to submit far smaller charcoal samples, often a tiny fragment of gracile vegetation such as a shrub, with the implication that this would have far less of a chance for long-term preservation than more substantial vegetation, and therefore more accurately date the period of occupation in question. The potential implication in prescribed and wildland fire contexts is that charcoal, from both trees and lighter vegetation, will be extremely abundant after a burn, and that this can enter archeological context through the action of fire itself (e.g., burned tree roots) and/or subsurface disturbances (e.g., rodent burrowing). Even if great care is exercised when selecting charcoal AMS samples, the potential exists that the most desirable sample material could be a product of recent fire activities.

Based on the analysis of carbonized botanical remains from sites burned over in the La Mesa Fire, Ford (1990) suggested that distinguishing cultural and natural charcoal was relatively straightforward. The former were thoroughly carbonized, exhibited no textural or color differences, and were more friable, while the latter were consistently harder, varied greatly in terms of combustion, and often only scorched or burned on a single surface. As a caveat, the La Mesa samples were obtained relatively soon after the area had burned. Given enough time, recent charcoal may well take on the characteristics of older material, and the survivorship of more thoroughly carbonized modern charcoal would be favored.

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